WILDLIFE HABITAT IMPACT ASSESSMENT

CHIEF JOSEPH DAM PROJECT, WASHINGTON

Project Report 1992

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Project No. 88-44
Contract Number DE-B179-91BP14775

January 1992

ABSTRACT

Under the Pacific Northwest Electric Power Planning and Conservation Act of 1980, and the subsequent Northwest Power Planning Council's Columbia River Basin Fish and Wildlife Program, a vildlife habitat impact assessment and identification of mitigation objectives have been developed for the U.S. Army Corps of Engineers' Chief Joseph Dam Project in north-central Washington. This study will form the basis for future mitigation planning and implementation.

The Habitat Evaluation Procedure (HEP) was used to evaluate wildlife habitat surrounding the Chief Joseph Dam Project lands to compare pre- and post-construction and current conditions. As a result of the original construction and operation of Chief Joseph Dam 8822 acres of terrestrial and riverine wildlife habitat were inundated or impacted. Twelve wildlife habitat types were identified for evaluation and mapped. Eleven wildlife indicator species were selected and evaluated to reflect wildlife habitat impacts. The net impacts are expressed in Habitat Units (HU's). For a given species, one HU is equivalent to one acre of optimum habitat.

The inundation of 8022 acres of wildlife habitat from the original construction of the Chief Joseph Dam Project, prior to the lo-foot pool rise, resulted in estimated losses of 907 HU's of mink habitat, 2050 HU's of sharp-tailed grouse habitat, 965 HU's of sage grouse habitat, 1233 HU's of spotted sandpiper habitat, 234 HU's of ring-necked pheasant habitat, 277 HU's of Lewis ' woodpecker habitat, 214 HU's of Canada goose habitat, 384 HU's of bobcat habitat, 57 HU's of yellow warbler habitat, and 1695 HU's of mule deer habitat. In contrast, the evaluation estimated 1440 HU's of lesser scaup winter feeding habitat were gained with the creation of Rufus Woods Lake.

In addition to the area inundated, 800 acres of terrestrial and riverine wildlife habitat were impacted by the original construction and operation of the Chief Joseph Dam Project. These areas included the construction sites, borrow pits, roads, spoil piles and equipment staging areas. These areas were evaluated so that associated construction impacts could be considered for mitigation under the Northwest Power Act along with the flooded areas. Through the Habitat Evaluation Procedure the following losses from construction were estimated: 14 HU's of mink habitat, 240 HU's of sharp-tailed grouse habitat, 214 HU's of sage grouse habitat, 22 HU's of spotted sandpiper habitat, 16 HU's of bobcat habitat, 10 HU's of Lewis' woodpecker habitat, four HU's of ring-necked pheasant habitat, one HU of yellow warbler habitat and 296 HU's of mule deer habitat. One HU of Canada goose habitat was gained through the creation of the four acre island known as the "Buttonhook".

Prioritized wildlife mitigation objective lists for tribal and non-tribal interests were developed to address these combined impacts to wildlife habitat.

ACKNOWLEDGMENTS

The authors wish to thank the following individuals and organizations for their contributions to the making of this report:

Tracy Lloyd (Project Supervisor, Washington Department of Wildlife).

Jay Weber (Douglas County Commissioner, member of Upper Columbia River Counties).

Don Galbreath (Ephrata Sportsmen's Club).

The Chief Joseph/Grand Coulee Steering Committee.

The Douglas County Steering Committee.

The following local residents we intervieved and the local landowners who allowed us on their property for the study: Paul Benson, V. Brock, Elsa Bourdette, Melba Cannon, Norm and Dan Cavadini, S. Jim Egbert, Kenneth Ehlers, Charles and Sharon Hammon, Lee and Joan Hanford, Lee Hemmer, Terry Hunt, Earl Jess, Dave McClure, Art McCuen, Janet Nelson, Eddie and Norris Palmanteer, Dale Rinker, Leroy Sanderson, Cliff Steveson, Jim and Kathy Short, Bill and Amy Tattersall, George Thalheimer, Melvin and Shine Thoren, Cecil and Eleanor Trefry, Tex Troutman, Harold Weber and Jack Wells.

The Bureau of Reclamation, Ephrata, for the loan of the stereoscope and room facilities for meetings.

Special thanks to the U.S. Army Corps of Engineers for the use of their boat during our study and to Bob Fischer for his excellent job of piloting.

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INTRODUCTION

This report presents an assessment of wildlife habitat impacts from original construction and operation of the U.S. Army Corps of Engineers' Chief Joseph Dam Project . The study objectives included: 1) identification of pre-construction, pre-project expansion, and current status of wildlife species in the study area; 2) estimation of the net effects on wildlife resulting from the original project development and current hydro operations; 3) development of prioritized protection, mitigation, and enhancement objectives for target wildlife species; 4) coordination of project activities with participating agencies; and 5) preparation of monthly progress reports, study draft and final reports. The study was funded by the Bonneville Power Administration under authority of Measure 1004 (b) (2) and (3) of the Columbia River Basin Fish and Wildlife Program adopted by the Northwest Power Planning Council pursuant to Section 4 (h) of the Northwest Electric Power Planning and Conservation Act of 1980.

This loss assessment focused only on impacts caused by the original construction and operation of Chief Joseph Dam and did not consider net impacts associated with the 1981 lo-foot pool rise. This study did not examine the net effects of agricultural or irrigation programs in the vicinity of Rufus Woods Lake. While an examination of the current net effects of local agricultural practices on wildlife was beyond the scope of this study, an evaluation of this extent would be based upon an ecosystem approach and consider all habitat types and native wildlife originally present. Although some species such as mule deer may have benefited from increased agricultural programs, other species such as sharp-tailed grouse and sage grouse have been significantly impacted by the conversion of shrub-steppe habitats.

Members of the Grand Coulee/Chief Joseph Wildlife Mitigation Steering Committee; Chief Joseph Wildlife Mitigation Technical Work Group; and state, federal and tribal agencies worked cooperatively to accomplish study objectives. These agencies included the Washington Department of Wildlife (WDW), Colville Confederated Tribes (CCT), U.S. Fish and Wildlife Service (USFWS), U.S. Army Corps of Engineers (COE), Bureau of Land Management (BLM), Upper Columbia River Counties, Northwest Power Planning Council (NPPC), and Bonneville Power Administration (BPA). Approximately 12 meetings and 25 on-site field trips were conducted by these agencies (from February 1991 to January 1992) to develop the impact assessment.

The Pacific Northwest Utilities Conference Committee was invited to be a member of the Technical Work Group, but chose not to participate.

The study was jointly directed by WDW and CCT. Wildlife losses were considered to be generally proportional relative to these jurisdictions. The state and tribe developed separate wildlife mitigation objectives to address respective wildlife needs. The USFWS assisted with technical implementation of the HEP, assessment of effects to wildlife, and development of prioritized mitigation objectives.

The Chief Joseph Wildlife Mitigation Technical Work Group provided technical review of the study, recommendations to the WDW and CCT, and provided primary assistance with REP fieldwork. The Grand Coulee/Chief Joseph Wildlife Mitigation Steering Committee acted as an avenue for local public review and input on study design and draft results. Membership of the work groups can be found in Appendix A.

Three public hearings were utilized during the course of the study. The first dealt with the study scope and objectives. The second focused on preliminary wildlife habitat loss estimates and the initial development of general mitigation objectives. The last public meeting reviewed draft study findings and mitigation objectives. A summary of public outreach and involvement efforts regarding this study can be found in Appendix B.

Approximately 700 draft study reports were distributed for written comment. A formal "response to comments" received in writing and verbally at public hearings is included in Appendix F.

WILDLIFE MITIGATION PROCESS UNDER THE POWER ACT

When Washington attained statehood over 100 years ago, the Columbia River flowed freely and provided important habitat for fish and wildlife resources. Salmon congregated each year at places like Kettle Falls (Chance, 1986) and the mouth of the Nespelem River.

Deer, furbearers, upland game birds, waterfowl and song birds used the edges of the river for food and cover. The riparian zone of the Columbia was an oasis in the arid eastern Washington landscape.

In the 19309, the federal government began a series of hydroelectric projects that changed the face of Washington's Columbia River Basin and eventually flooded as much as 100,000 acres of the limited riparian and flood plain habitat available to wildlife in these areas. These projects, while contributing to the prosperity of the Pacific Northwest as a whole, significantly contributed to the decline of wildlife habitat in the Columbia Basin.

Complex wildlife habitats were converted to sterile shorelines of limited wildlife use. Fluctuating water levels prevented the re-establishment of riparian plant communities needed to provide essential wildlife habitat.

Until Congress passed the Pacific Northwest Electric Power Planning and Conservation Act (1980) creating the NPPC, there was little hope that wildlife restoration would take place to address losses associated with some of the federal hydroelectric dams in this state.

The Northwest Power Act required the NPPC to develop a program and the BPA to fund this program to "protect, mitigate, and enhance fish and wildlife affected by the development and operation of hydropower projects on the Columbia River and its tributaries" (USFWS, et al., 1981). To implement

this mandate, the NPPC established in its 1982 Fish and Wildlife Program a planning process to address the impacts of hydropower development and operation on wildlife in the Columbia Basin. The Fish and Wildlife Program was modified in 1989 when the NPPC developed the current Wildlife Rule, defining the process of determining federal hydropower impacts to wildlife habitat and the development of general wildlife mitigation objectives.

The Chief Joseph facility is one of the last hydroelectric projects to be studied in this process to date. No mitigation actions have occurred to address the impacts from the original construction and operation of Chief Joseph Dam.

The following outline provides an overview of the planning and implementation process. This Chief Joseph Dam impact assessment completes steps two and three of this process.

1. A Review and Analysis of the Status of Wildlife Planning and Mitigation. This was completed for all federal dam projects in 1984.

2. Development of Wildlife Habitat Loss Statements. Both positive and negative effects on wildlife habitat from the construction and operation of hydroelectric facilities are measured and quantified. These are normally developed on a project-by-project basis.

3. Development of Wildlife Mitigation Objectives. Generic wildlife mitigation objectives are developed identifying and prioritizing the species and habitats that should be addressed.

4. Program Amendments by NPPC. The NPPC considers, accepts or amends the wildlife loss statements and mitigation objectives. NPPC action is required prior to BPA implementing mitigation projects.

5. NPPC Establishment of Sub-basin Wildlife Mitigation Goals. The NPPC determines mitigation priorities within three Columbia River subbasins: Upper Columbia, Lower Columbia and Snake River. These priorities are based in part upon mitigation objectives developed during loss assessment studies for individual federal dams. NPPC has established an interim goal to address approximately 35 percent of the identified losses within the Columbia River Basin over a lo-year period.

6. BPA Implementation. Mitigation planning of specific on-the-ground actions will not take place until wildlife habitat losses have been accepted by NPPC. Mitigation actions require NPPC approval.

STATUS OF WILDLIFE IN STUDY AREA

Historically, native American Indians of the region used the natural resources in a subsistence lifestyle and later traded with early trappers (Dryden, 1949). Salmon were the mainstay of the Indian diet and along with other wildlife species contributed to most of their food, clothing, shelter and

tools (Ruby and Brown, 1981). Fish formed a critical component of the wildlife food web prior to construction of Chief Joseph Dam. Various plant species that grew in and along the river were also utilized for food, medicinal and various other uses. Today the members of the CCT still utilize some of these remaining natural resources in a subsistence manner and as a part of their cultural and religious heritage (Judd, 1991).

To the early pioneers who settled and developed the region, wildlife was a source of food or a competitor for the natural resources available. Settlers depended on these resources to make a living and to build for the future (Cannon, 1987).

Lorraine (1924) provided an early description of the Columbia River between what is now Chief Joseph Dam and Grand Coulee Dam. He observed 14 sets of rapids, five ferry crossings, several post office sites and old hotels.

The economics of the area was based on farming, ranching and commerce. While the Columbia River dams were being built, the area prospered through the influx of new residents (Downs, 1986). Currently wildlife recreation provides significant economic benefits at both the state and local community levels.

The majority of landowners who have lived in the area all their lives were interviewed to help gather historical insight to the pre-project status of wildlife species. According to the landowners the area supported diverse wildlife (unpublished report, 1977). Sage grouse numbered in the hundreds, and sharp-tailed grouse numbered into the thousands (Hanford, 1991; and Weber, 1991). Grey partridge, beaver, muskrat, cottontail and jackrabbits, coyote, bobcat, Chinese ring-necked pheasant, waterfowl, nongame birds, black bear, cougar, rattlesnakes, and various raptors were numerous (Cannon, 1991; Hanford, 1991; E. and N. Palmanteer, 1991; Thalheimer, 1991; Thoren, 1991; Trefry, 1991; Troutman, 1991; Weber, 1991; and Wells, 1991). The region also provided winter habitat for mule deer and occasionally white-tailed deer (Hammond, 1991; and Thompson, 1991). Other species found in the project area included dove, chukar, quail, forest grouse, furbearers, burrowing owl, and various non-game species (Oliver and Barnett, 1966; Tabor, et al., 1980; Troutman, 1991; and Friesz, 1991).

Many of the area residents believe waterfowl numbers have increased as a result of the stability of the reservoir (Hanford, 1991; Short, 1991; Troutman, 1991; and Weber, 1991). In addition, mule deer and coyote numbers appeared to have increased in part from changes in agricultural practices (Benson, 1991; Hanford, 1991; Hemmer, 1991; McClure, 1991; and Weber, 1991). Other wildlife numbers tended to be much lower for a variety of reasons (Friesz, 1991; Weber, 1991; and Troutman, 1991).

Lists of the fauna1 and floral species in the study area, pre-construction and current, their abundance and season of occurrence can be found in Appendix C. For additional references on plant and wildlife species occurrence in the study area please refer to Payne, et al. (1975); COE (1976, 1980a and 1980b); Foster, et al. (1982); Carson (1985); Sullivan (1986); and Griffith (1988).

PROBLEMS FACING WILDLIFE IN WASHINGTON

Wildlife in north-central Washington face critical problems similar to those in the rest of the state--loss of native habitat. Each year in Washington over 30,000 acres of habitat are converted to uses inconsistent with wildlife. Peregrine falcons are federally endangered, and bald eagles are federally threatened. Numerous species, including white pelicans, sandhill cranes, and upland sandpiper, are currently endangered species as a result of habitat loss.

More specifically for eastern Washington, over 60 percent of the native shrub-steppe habitat has been destroyed and the majority of that remaining is extremely fragmented, significantly reducing its value for native wildlife. As a result, sharp-tailed grouse and sage grouse populations have been depressed to such low levels they are currently proposed as state and federal candidate species for classification as threatened or endangered. Washington pygmy rabbits are currently considered state threatened. See Appendix C-5 for WDW list of state and federally recognized species of special concern.

Hydroelectic development has contributed significantly to the loss of native habitat, both directly and indirectly. According to Oliver (1974) 94 hydroelectric power projects in Washington have inundated 426,000 acres of land, roughly one percent of the total land area in the state. The free flowing integrity of our two major rivers, Columbia and Snake, has already been destroyed. Only 51 miles of the Columbia River mainstem, and 100 miles of the Snake River are still free flowing in Washington (Kim, 1991). Approximately 90 percent of original wetlands in western and 50 percent of the original wetlands in eastern Washington have also been destroyed (WDW, 1991).

The conversion of native habitats to agricultural uses, intensive grazing, residential/recreational developments, hydroelectric projects, the use of pesticides/herbicides, pollution and the demands placed on available water supplies have all contributed to significant declines of native wildlife and wildlife habitat.

Treated separately, resultant impacts might be considered unimportant to some, but when considered collectively these impacts clearly define the urgent need to protect and enhance remaining key wildlife habitats.

CHIEF JOSEPH DAM FACILITY AND RESERVOIR

In 1946, the River and Harbor Act gave the COE authorization for initial installation of 16 generating units at Chief Joseph Hydroelectric Dam, operated for the purposes of power generation (98%) and water storage for irrigation (2%). Construction of the dam began in 1948 (COE, 1953). Hydroelectric power generation began in 1955 and by 1958 all 16 units were on line (COE, 1967 and 1978). Construction to add an additional 11 units (17-27) began in 1974 and was completed in 1981 (COE, 1975 and 1980b). The pool formed was called Rufus Woods Lake, a 51-mile-long reservoir situated on the upper Columbia River in north-central Washington, between river miles 545.5

and 596.5. Rufus Woods Lake contains 106 miles of shoreline and occupies a surface area of about 8600 acres. The towns of Bridgeport and Coulee Dam lie at each end of the reservoir near Chief Joseph Dam and Grand Coulee Dam, respectively (Figure 1).

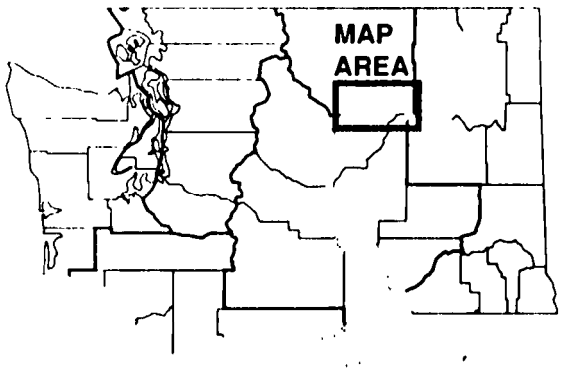
The north side of the river is located in Okanogan County on the Colville Indian Reservation. The south side of the river is in Douglas and Grant counties, and is in state, federal and private ownership. The COE operates Chief Joseph Dam and administers the reservoir except for the six uppermost river miles, which the Bureau of Reclamation controls as part of the Grand Coulee Dam project (Erickson, et al., 1977).

In 1981 operation of generator units 17-27 required the pool behind the dam be raised from 946 to 956 feet mean sea level. This lo-foot pool rise inundated 443 acres of shoreline habitat and 173 acres of critical island/sandbar habitat (Erickson, et al., 1977). This action reduced the free flowing upstream portion of the Chief Joseph pool from eight miles to two and a half miles. During a separate study the Habitat Evaluation Procedure was used to determine the impacts from the additional units project (Fielder, 1976). The COE now manages and monitors 16 mitigation sites developed to compensate for inundation and operation impacts to wildlife and wildlife habitat that resulted from the lo-foot pool rise (Fielder, 1977a and 1977b; Shapiro and Associates, 1987 and 1989).

Pertinent data regarding the hydrology, reservoir storage, pool elevation, spillway, power intake and power house can be found in "Design Memorandum 52" (COE, 1980b). The 27 generating units have the capacity to produce 2,460 mega watts of electricity, making this dam the second largest hydroelectric power producer in the United States (Fischer, 1991).

FIGURE 1.

General Location Map - Chief Joseph Dam Project Wildlife Habitat Impact Assessment



General Boundary of Study Area
Borrow pits downstream
Spoils piles in Foster Creek
Staging areas around Chief Joseph Dam
Rufus Woods Lake

COLVILLE INDIAN RESERVATION
Nespelem River
Sanpoil River
Okanogan River
Columbia River
Rufus Woods Lake
BRIDGEPORT *
Chief Joseph Dam
ELMER CITY
COULEE DAM
Grand Coulee Dam
* GRAND COULEE
W Foster Creek
E Foster Creek

STUDY AREA

The primary impact area for the Chief Joseph Dam Wildlife Habitat Impact Assessment is defined as that area including the dam, support facilities and river upstream to Grand Coulee Dam. Adjoining backwaters and tributaries inundated by the reservoir are included. There also exists the non-inundated but affected areas in and around Chief Joseph Dam. These areas include the equipment staging areas, borrow pits utilized for the rock source, spoil piles from the pool excavation, and facility construction sites within a short distance of the dam. Prior to dam construction, Foster Creek was a riparian area with groves of deciduous trees (Hanford, 1991); construction resulted in it being partially filled with spoil of depths up to 115 feet (Fischer, 1991).

The northern-most boundary of the Columbia Plateau, consisting of prehistoric lava flows, occurs on the western portion of Rufus Woods Lake. On the eastern end of the lake, these flows were halted by the foothills of the Okanogan Highlands (Stradling, 1980). The entire area is underlain by granite substrate (Carson, 1985). The topography of the project area includes terrain rising both gently and abruptly to low lying hills or mountains 1,000 feet or more above the Columbia River. The study area is in a canyon varying from to to four miles wide composed of long table-top benches occurring along the lake with occasional deep draws and rock outcropping (Erickson, et al., 1977). The Nespelem River is the only significant stream entering Rufus Woods Lake.

Soils of the area, classified and mapped by the U.S. Department of Agriculture (1981), are composed of weathered granite and basalt with deposits of glacial till overlain with loess.

The climate of the area is semi-arid with hot dry summers, and cold dry winters. Summer daytime temperatures average in the 80s (F) and winter daytime temperatures average in the 40s (COE, 1980b). Annual extremes range from highs of 110 degrees to lows of -20 degrees (F). Annual precipitation ranges from 10 to 20 inches, most of which falls as snow (COE, 1980b). Winds are light, generally from the northwest or northeast; however, speeds up to 20 MPH are not uncommon.

The vegetation of the area is typical of shrub-steppe communities containing big sagebrush (Artemisia tridentata), threetip sagebrush (Artemisia tripartita), bitterbrush (Purshia tridentata), bluebunch wheatgrass (Agropyron spicatum), Idaho fescue (Festuca idahoensis), needle-and-thread (Stipa comata) and cheatgrass (Bromus tectorum) (Daubenmire, 1970; Daubenmire and Daubenmire, 1968; Carson, 1985; and Sullivan, 1986).

Within the study area, deciduous shrubs, such as mockorange (Philadelphus lewisii), red-osier dogwood (Cornus stolonifera), and serviceberry (Amelanchier alnifolia) are common in moist draws. Where water is present, a number of deciduous trees including quaking aspen (Populus tremuloides), cottonwood (Populus trichocarpa), water birch (Betula occidentalis), hawthorn (Crataegus sp.), and mountain alder (Alnus incana) occur. Ponderosa pine (Pinus ponderosa) and Douglas fir (Pseudotsuga menziesii) occur at various points along Rufus Woods Lake and upper ridge areas (Erickson, et al., 1977).

METHODS

Wildlife Habitat Analysis

Pre-construction wildlife habitat types of the Chief Joseph Dam and Reservoir study area were mapped based on aerial photo-interpretation techniques (Spurr, 1960) of black and white aerial photos taken in March of 1930. Although a fire destroyed the original negatives in 1944, copies were made of the original set of photos, which were supplied by the Seattle District Office of the COE. Comparisons were made with Soil Conservation Service photos taken prior to dam construction in July 1939, 1941 and June 1949 at the Waterville District office to determine accuracy. A set of black and white aerial photos taken in September 1975 was used to avoid inclusion of habitat losses associated with the additional lo-foot pool rise. Color aerial photos taken September 1979 were used to further interpret the different wildlife habitat types.

The aerial photographs were examined under a mirror stereoscope. Areas of discernable, different wildlife habitat types were noted and outlined on a base map and labeled with colors designating different wildlife habitat types. Sample sites for ground truthing review of habitats were located on the base map in each representative wildlife habitat type using known landmarks, topography and field observations.

Original and post-construction habitat conditions were mapped on 1:24,000 USGS quadrangle maps. Selected wildlife habitat types were based, in part, on categories defined by Erickson, et al. (1977).

The mapped habitat types and aerial photos were ground-truthed in April 1991, using Blomstrom and Detrich (1980), Hitchcock and Cronquist (1973), and Spellenberg (1979). After field confirmation, acreage figures for the wildlife habitat types were obtained by dot gridding both the aerial photos and the 1:24,000 USGS topographic maps of the study area. The minimum unit measured was one acre.

Field notes of the original land surveys of 1883 through 1908 were reviewed to verify descriptions of the land, ground vegetation and size of trees used for reference markers.

Wildlife information respective of the area was gathered from reference materials, personal communication with people who lived in the study area, local wildlife biologists, state and tribal field data.

Twelve wildlife habitat types were identified in the Chief Joseph Project study area. Tables 1A and 1B show the acreage for each habitat type affected by the original dam construction project.

Table 1A. Wildlife Habitat Inundated by Original Dam Construction

Habitat type	Pre-const. (Acres)	Post-const. (Acres) Prior IO-ft Pool Rise	Net Changes
1. Lacustrine	0	7926	+7926
2. Riverine	2926	0	-2926
3. Shrub-steppe	1463	0	-1463
4. Sand/Gravel/Cobble	1167	0	-1167
5. Riparian/Macrophyllus Draws	648	0	- 648
6. Agriculture	366	0	- 366
7. Rockland	355	0	- 355
8. Ponderosa Pine Savanna	346	0	- 346
9. Island/Sandbar	337	96	- 241
10. Rock	231	0	- 231
11. Mixed Forest	93	0	- 93
12. Palustrine (ponds/slackwater)	90	0	- 9 0
Subtotal	8022	8022	

Table 1B. Non-Inundated Wildlife Habitat Affected By Original Dam Construction

Habitat Type	Pre-const. (Acres)	Current (Acres)	Net Changes
1. Lacustrine	0	0	0
2. Riverine	110	126	+ 16
3. Shrub-steppe	531	313	- 218
4. Sand/Gravel/Cobble	48	31	- 17
5. Riparian/Macrophyllus Draws	21	11	-10
6. Agriculture	48	71	+ 23
7. Island/Sandbar	1	4	+ 3
8. Rock	25	0	- 25
9. Mixed Forest	13	0	-13
10. Palustrine (ponds/slackwater)	3	3	0
11. Developed	0	241	+ 241
Subtotal	800	800	
Total wildlife habitat acres inundated or affected by original dam construction	8822	8822	

Description of Wildlife Habitat Types

The following section provides an overview description of each habitat type classification.

1) Lacustrine: Includes wetlands and deepwater habitats of damned river channels; lacks trees, shrubs or persistent emergents due to wave action. Representative hydrophytic plants include water weed (Elodea sp.), curlyleaf pondweed (Potamogeton crispus), sago pondweed (Potamogeton pectinatus), water milfoil (Myriophyllum sp.), and Eurasian milfoil (Myriophyllum spicatum).

2) Riverine: Habitat formed by or resembling a free flowing river; vegetation living or situated on the banks of a river. Principle tree species include water birch, black cottonwood and mountain alder. The shrub layer includes Columbia hawthorn (Crataegus columbiana), red-osier dogwood, willow (Salix sp.), serviceberry, chokecherry (Prunus virginiana), mockorange and pearhip rose (Rosa woodsii). Representative herbs include horsetail (Equisetum sp.), Dutch rush (Equisetum hyemale), watercress (Rorippa nasturium-aquaticum), mint (Mentha sp.), and sweetclover (Melilotus sp.).

3) Shrub-steppe: Dry sites devoid of trees, vegetative surface area covered by shrubs and herbs, ground surface dominated by bare ground, litter, rock and erosion pavement. Principal vegetation includes big sagebrush, threetip sagebrush, rabbitbrush (Chrysothamnus nauseosus), bitterbrush, cheatgrass, Idaho fescue, Indian wheat (Plantago patagonica), bluebunch wheatgrass, and needle and thread grass.

4) Sand/Gravel/Cobble: Shoreline of the original river, the size of which varied with the yearly runoff, debris deposits, etc. Areas below ordinary high water mark lacking vegetation. Sparse cover of herbaceous vegetation is likely present on many of these sites.

5) Riparian/Macrophyllus Draws: Closely associated with surface water and seasonally moist draws radiating away from the river and interrupting the shrub-steppe community. Deciduous trees may include quaking aspen, cottonwood, water birch and mountain alder. Occasionally rocky substrate with substantial shrub layer but reduced herb layer. The shrub layer includes Columbia hawthorn, willow, red-osier dogwood, common snowberry (Symphoricarpos albus), serviceberry, mockorange, smooth sumac (Rhus glabra), and pearhip rose. Western virgin's bower (Clematis ligusticifolia) is the dominant vine. Horsetail, Dutch rush, watercress, northern bog violet (Viola nephrophylla), American bulrush (Scirpus americanus), and porcupine sedge (Carex hystricina) grow in wet areas adjacent to the open water.

6) Agriculture: Native vegetation sites converted by man for producing agricultural crops. They are found on flat benches along the river. The majority of agricultural lands are used to produce hay, cereal grains, orchards and vineyards. Farm buildings and private roads are also considered under this habitat type.

7) Rockland: Shrub-steppe habitat scattered with the occurrence of small to large haystack rock deposits of basalt. A higher diversity of shrubs is associated with the micro-environment of the haystack rocks. Shrubs present include threetip sagebrush, big sagebrush, bitterbrush, serviceberry,

rabbitbrush, buckwheat (Eriogonum sp.), and mockorange. Idaho fescue, needle-and-thread, bluebunch wheatgrass, cheatgrass, and Indian-wheat comprise the main herbs, along with arrowleaf balsamroot (Balsamorhiza sagittata), nine-leaf lomatium (Lomatium triternatum), long-leaved phlox (Phlox longifolia) and blanket flower (Gaillardia aristata) making up the less abundant herbs. Trees are absent except for the occasional ponderosa pine.

8) Ponderosa Pine Savanna: Scattering of ponderosa pine in narrow strips along the river with grassland vegetation and macrophyllous understory. Cobble stones dominate the ground cover. Most abundant shrubs include serviceberry, mockorange, bitterbrush, squaw currant (Ribes cereum), and tall Oregon grape (Berberis aquifolium). Other herbaceous plants include cheatgrass, Idaho fescue, and bluebunch wheatgrass.

9) Island/Sandbar: Islands or bars of sand, gravel, cobble, boulders or rock occasionally under water. Trees include ponderosa pine, Douglas fir, water birch, and Rocky Mountain juniper (Juniperus scopulorum). Shrubs include serviceberry, bitterbrush, buckwheat, pearhip rose and chokecherry. Herbs include yarrow (Achillea millifolium), sedge (Carex sp.), and bluebunch wheatgrass, depending on the soils and elevation above the river. Each island/sandbar had its own unique vegetation.

10) Rock: Rock habitat was comprised of steep topography, usually excluding grazing, found mainly on north facing slopes, or major rock outcrops along the river. Vegetation includes western virgin's bower and deep rooted shrubs, principally serviceberry and mockorange. Herbaceous plants include cheatgrass, bluebunch wheatgrass, arrowleaf balsamroot, Idaho fescue and Sandberg bluegrass (Poa sandbergii).

11) Mixed Forest: Habitat comprised of stands of both coniferous and/or deciduous trees and shrubs. Tree species present include ponderosa pine, Douglas fir, black cottonwood, water birch, and mountain alder which occur along the river in large isolated patches, usually on steep north-facing slopes or associated with draws containing perennially flowing springs. Habitat includes a substantial litter layer, moderate understory and ground flora with insignificant occurrence of rocks. Understory species include Columbia hawthorn, willow, red-osier dogwood, common snowberry, serviceberry, mockorange, smooth sumac, pearhip rose, Rocky Mountain juniper, tall Oregon grape, bitterbrush, squaw currant, threetip sagebrush and oceanspray (Holodiscus discolor) with cheatgrass and a variety of bluegrass and wheatgrasses.

12) Palustrine: Vegetated wetlands such as marshes, also includes small, shallow, permanent or intermittent water bodies like ponds, bays, coves or slackwater with emergent vegetation and scrub/shrub. Herbal species include horsetail, Dutch rush, watercress, northern bog violet, American bulrush, shore buttercup (Ranunculus cymbalaria), porcupine sedge and common cattail (Typha latifolia). Trees and shrubs include water birch, mountain alder, willow and red-osier dogwood.

13) Developed: Relating to construction sites, buildings, parking lots, roads, borrow pits, spoil piles, equipment staging areas, and dam facilities.

Habitat Evaluation Procedure

Habitat evaluation procedures (Federal Register, 1981) developed by the U.S. Department of Interior (1976 and 1980) were utilized to evaluate the quality of pre- and post-construction wildlife habitat in this Chief Joseph study consistent with other BPA-funded mitigation studies. The HEP consisted of an Interagency Technical Work Group responsible for selecting representative habitats and indicator species for evaluation (Wakeley and O'Neil, 1988). Selection of the species utilized in the evaluation was based on their particular habitat requirements indicative of certain vegetative types representing a larger group of wildlife species with similar habitat requirements, or because they were of special significance in the study area from an economical, ecological, social, or environmental point of view. A list of all plant and wildlife species utilized in the selection process for the project area is provided in Appendix C.

Habitats similar to those actually flooded were located adjacent to Rufus Woods Lake in order to estimate the value of the lands originally impacted.

The HEP field team analyzed habitat conditions based on the HEP models developed for each species. Field evaluation of sample sites representing the inundated area was carried out separately from the non-inundated areas affected by the original construction. These affected areas were not addressed during the lo-foot pool mitigation and were, therefore, evaluated for their current condition as wildlife habitat.

Originally a total of 25 species were proposed as indicator species (Audubon Society, 1983; Burt, et. al., 1964; Peterson, 1990; and Steddins, 1966) by the Technical Work Group. Eventually, 11 indicator species were chosen to analyze habitat conditions, based on the availability of HEP models developed for those species. These 11 indicator species and the rationale for their selection are identified in Table 2.

Table 2. Wildlife Habitat Indicator Species and the Rationale for Their Selection

Species	Rationale
Lesser Scaup (Aytha affinis)	A migratory waterfowl species commonly observed utilizing open water habitat of Rufus Woods Lake during winter months. Representative of other diving waterfowl using the area. Published HEP model available.
Mink (Mustela vison)	Carnivorous furbearer which feeds upon a wide range of vertebrates and utilizes shoreline and adjacent shallow water habitats. Published HEP model available. Cultural significance.
Sharp-tailed Grouse (Tympanuchus phasianellus)	Upland game bird representing native grasses and shrub-steppe community. Relies heavily on riparian draws and woody ravines for cover and winter food supply. Current state and federal candidate species for listing as threatened or endangered. Unpublished HEP model available.
Sage Grouse (Centrocercus urophasianus)	Native upland game bird representing wildlife dependent on sagebrush communities and rockland habitats. Current state and federal candidate species for listing as threatened or endangered. Unpublished HEP model available.
Mule Deer (Odocoileus hemionus)	Big game representing wildlife using browse, forbs and grasses. Thermal cover and varied topography are also represented. Cultural significance. Unpublished HEP model available.
Spotted Sandpiper (Actitis macularia)	A representative of the shorebirds which utilize the sparsely vegetated islands, mudflats, shorelines, and sand and gravel bars. Unpublished HEP model available.
Ring-necked Pheasant (Phasianus colchicus)	Upland game bird dependent on farm crops to meet their food requirements. Nesting habitat and winter cover are also represented. Unpublished HEP model available.

Table 2 (Cont.)

Species	Rationale
Lewis' Woodpecker (Melanerpes lewis)	Represents wildlife requiring trees large enough for cavity nests. Inhabits open forest stands and feeds on insects, fruits and berries. Published HEP model available.
Canada Goose (Branta canadensis)	A migratory waterfowl of national significance sensitive to island nesting habitat and associated brooding areas. Cultural significance. Unpublished HEP model available.
Yellow Warbler (Dendroica petechia)	Represents species which reproduce in riparian shrub habitat and make extensive use of adjacent wetlands. Published HEP model available.
Bobcat (Felis rufus)	Represents both the predator and prey base using rock and rockland habitats. Rocky terrain is important habitat component. Unpublished HEP model available.

The HEP models for the lesser scaup (Mulholland, 1985), mink (Allen, 1986), yellow warbler (Schroeder, 1982), and Lewis' woodpecker (Sousa, 1983) have all been published and are available from the USFWS. The spotted sandpiper model (adapted from Dorsey, 1987), ring-necked pheasant, Canada goose (adapted from Martin, et al., 1988, and Sather-Blair and Preston, 1985), mule deer, sharp-tailed grouse and sage grouse (Ashley, 1990), and bobcat (Bodurtha, 1991) models are all unpublished and presented in Appendix D. Some of the HEP models were modified to reflect local conditions and specific wildlife needs.

The HEP model for each species uses measurable variables that are combined into an equation which provides the sample site Habitat Suitability Index (HSI) for that particular species. A weighted HSI value is determined for each species utilizing all the sample sites after being weighted by the size of the area sampled. This overall HSI, which is a number between 0 and 1, is a quality index or measure of the capacity of the area to meet the life requisites of the indicator species.

To evaluate changes in habitat quality associated with this project using the HEP, three time periods had to be considered: 1) baseline or pre-construction, 2) pre-10 foot pool rise or post-construction, and 3) present conditions. Upon review of available data, aerial photographs and field inspection, the evaluation team agreed that habitat quality present in parts of the project area was representative of the vegetation communities inundated by the

original construction project. Successional and land use changes have altered the quality of some of the habitat communities over time; however, the same average HSI value for each habitat type measured by the HEP team was applied to both pre- and post-project conditions.

The interagency team of biologists and volunteers spent 16 days in the study area measuring a total of 45 different variables for the wildlife indicator species found in the 12 habitat types. Field measurements of habitat variables were conducted on randomly selected sample plots in each habitat type. Attempts were made to vary the aspect, slope and location of sample sites to ensure acquiring an unbiased sample. A total of 176 transects were measured from 87 sample sites.

Values derived from field measurements were used to develop an HSI rating for each species. Each HSI value was multiplied by the total number of acres of the associated wildlife habitat type affected by the original construction project to determine the number of habitat units for each indicator species. The HU's for each indicator species represents the gains or losses of habitat as a result of the original project. The following discussion relates the indicator species with the wildlife habitat type and variables measured to determine HSI values.

Lesser Scaup - The HEP team evaluated four sample sites with 10 measurements at each site. Habitat variables measured included percent of the area supporting emergent or submergent vegetation, percent of the area supporting animal or vegetative matter, water depth during average winter conditions, and human disturbance in the feeding area.

Mink - Habitat variables measured included the percentage of shoreline cover within three yards of the water's edge, the percentage of tree/shrub canopy within 40 yards of the water's edge, and the percentage of the year water is present. These variables were measured at five sites for the riverine habitat.

Sharp-tailed Grouse - Habitat variables measured on 20 shrub-steppe sites, four rockland habitats, and 11 riparian/macrophyllus draws included the average height of herbaceous plants; the distance to winter range; the percentage of canopy cover of shrubs; the percentage of herbaceous cover; the percentage of bud producing shrubs and trees; distance to leks; the average height of shrubs; and the percentage of shrub and tree canopy cover.

Sage Grouse - The HEP team measured two variables: the percentage of sagebrush cover and the average sagebrush height on 20 shrub-steppe and four rockland sites.

Spotted Sandpiper - Eleven sand/gravel/cobble and five island/sandbar sites were sampled by the evaluation team to measure nesting and foraging distance from water, foraging habitat and value of herbaceous cover.

Ring-necked Pheasant - The HEP team evaluated nine agricultural areas to measure food value, distance to winter cover, and reproductive cover variables.

Lewis' Woodpecker - The HEP team measured the following habitat variables at four sites in the mixed forest and four sites in the ponderosa pine savanna:

percentage of deciduous canopy cover for feeding areas, the percentage of overstory tree canopy cover, and the density of snags greater than 12 inches in diameter for potential cavity trees.

Canada Goose - Five island habitats were evaluated for nesting distance to brooding pasture, size of brooding area, and height of herbaceous cover.

Bobcat - Four rock and four rockland habitat sample sites were evaluated by the HEP team to measure grass/shrub distribution, vegetative cover and the percentage of rocky ledges, rock outcrops, and cliff edges.

Yellow Warbler - The HEP team measured the following three variables: the percentage canopy cover of deciduous shrubs, the mean height of deciduous canopy cover and the percentage deciduous shrub canopy of hydrophytic species. Six sites were evaluated in the palustrine habitat.

Mule Deer - The HEP team sampled 20 sites in the shrub-steppe, four in the rockland, four in the mixed forest, and four in the ponderosa pine savanna. The following habitat variables were measured: the percentage of preferred shrubs, the percentage of ground cover in herbs, the percentage of canopy cover of shrubs, variable topography, and the percentage of canopy cover greater than six feet to measure thermal protection.

FINDINGS

The average HSI scores for each wildlife habitat indicator species and respective habitat units are summarized in Appendix E for inundated and non-inundated acres affected by construction. Following are changes in habitat units derived utilizing HEP for each of the wildlife habitat indicator species. Tables 3 and 4 summarize these changes.

Changes in Habitat Units for Inundated Areas

Lesser Scaup - During the winter, lesser scaup rest and forage in the open water habitat of the Rufus Woods Lake. The original construction project created 7926 acres of open water habitat. Of this, 1500 acres were suitable for winter feeding habitat for the lesser scaup; the remaining lake area was too deep or flowing too fast to utilize. The quality of the feeding area was high as reflected in a high HSI value (HSI=0.96). This resulted in a net increase of 1440 habitat units for the lesser scaup from the construction of Chief Joseph Dam.

Mink - Mink utilize the shoreline and adjacent shallow water habitats in the study area. The 1744 acres of riverine habitat lost from the project were moderate value (HSI=0.52) to the mink. The net impact to mink was a loss of 907 HU's.

Sharp-tailed Grouse - Shrub-steppe conditions reflected a moderately high value for summer range (HSI=0.85). The rockland type was identified to be a more valuable summer range (HSI=0.92), and the riparian/ macrophyllus draws moderately high winter range value (HSI=0.74). Collectively the impacts

resulted in a loss of 2050 HU's to the sharp-tailed grouse on a total of 2466 acres.

Sage Grouse - The variation of sagebrush habitat provided moderately low value to the sage grouse (HSI=0.48), but the rockland habitat had a moderate rating (HSI-0.74). Together they resulted in 965 HU's lost to the sage grouse on 1818 acres.

Spotted Sandpiper - The sand/gravel/cobble habitat had a moderately high rating (HSI=0.85), while the island/sandbar rated ideal for the sandpiper (HSI-1.0). After considering the creation of 96 new acres formed by Rufus Woods Lake, the net impacts resulted in a loss of 1233 HU's for the spotted sandpiper on 1504 acres.

Ring-necked Pheasant - The agricultural areas varied considerably for the pheasant. HSI values were dependent on whether the area was harvested during the breeding season and/or provided critical winter food and cover. The study area had pasture, orchard, hay and grain crops with an above average rating (HSI=0.64) resulting in a loss of 234 HU's for the pheasant on 366 acres.

Lewis' Woodpecker - The ponderosa pine savanna had a moderate rating (HSI=0.60) and the mixed forest a moderately high rating (HSI=0.74) for a combined loss of 276 HU's to the Lewis' woodpecker on 439 acres. The mixed forest provided more snags/acre and better insect foraging areas than the open ponderosa pine habitat.

Canada Goose - The pre-construction island/sandbar habitat had a high rating (HSI=0.89). The Canada goose was adversely impacted with the loss of 337 acres. However, this figure doesn't reflect the more important impact to nesting sites as six larger islands and sandbars were lost along with 688 smaller islands identified off aerial photos. Although islands were flooded, new islands were also created as the water rose. An estimated 96 acres of new islands were formed before the lo-foot pool rise and resulted in a net impact of 214 HU's lost to the Canada goose.

Bobcat - The bobcat had suitable habitat in both the 231 acres of rock habitat and 355 acres of rockland. They rated similarly (HSI=0.65 and 0.66, respectively) and combine for a loss of 384 HU's for the bobcat.

Yellow Warbler - The yellow warbler reproduces and feeds in the scrub-shrub habitat associated with wetlands around small ponds, bays and slackwater. The original construction project reflected a loss of 90 acres of palustrine habitat. The HSI value of 0.63 resulted in a loss of 57 HU's for the yellow warbler.

Mule Deer - The area supports a major population of mule deer which use almost all of the habitats, but concentrate in the study area primarily during winter months. The 1463 acres of shrub-steppe had a moderate rating (HSI=0.71). Preferred shrubs increased in the rockland habitat and the rating on 355 acres increased (HSI=0.77). The mixed forest which contained thermal cover produced a higher rating (HSI=0.81) on 93 acres, and the 346 acres of ponderosa pine savanna with its thermal cover, grasses and browse also rated a high value (HSI=0.89). Collectively, the impacts resulted in a loss of i695 HU's for the mule deer.

Table 3. Wildlife Habitat Units Lost/Gained From Inundation of Rufus Woods Lake

Habitat Type	Pre-Constr. Habitat Units Lost	Post-Constr. Habitat Units Gained	Net Change
1. Lacustrine (Rufus Woods Lake)			
Lesser Scaup (Feeding)	0.00	1440.00	+1440.00
2. Riverine (flowing river)			
Mink	906.88	0.00	-906.88
3. Shrub-steppe			
Sharp-tailed Grouse	1243.55	0.00	-1243.55
Sage Grouse	702.24	0.00	-702.24
Mule Deer	1038.73	0.00	-1038.73
4. Sand/Gravel/Cobble			
Spotted Sandpiper	991.95	0.00	-991.95
5. Riparian/Macrophyllus Draws			
Sharp-tailed Grouse	479.52	0.00	-479.52
6. Agriculture			
Ring-necked Pheasant	234.24	0.00	-234.24
7. Rockland			
Sharp-tailed Grouse	326.60	0.00	-326.60
Sage Grouse	262.70	0.00	-262.70
Bobcat	234.30	0.00	-234.30
Mule Deer	273.35	0.00	-273.35
8. Ponderosa Pine Savanna			
Lewis' Woodpecker	207.60	0.00	-207.60
Mule Deer	307.94	0.00	-307.94
9. Island/Sandbar			
Canada Goose	299.93	85.44	-214.49
Spotted Sandpiper	337.00	96.00	-241.00
10. Rock			
Bobcat	150.15	0.00	-150.15
11. Mixed Forest			
Lewis' Woodpecker	68.82	0.00	-68.82
Mule Deer	75.33	0.00	-75.33
12. Palustrine (ponds, slackwater)			
Yellow Warbler	56.70	0.00	-56.70

Changes in Habitat Units for Non-Inundated Areas Affected by Construction

Mink – Originally the riverine habitat provided 34 acres of mink habitat. Now after dam construction 26 acres of mink habitat remain (original HSI equalled 0.52). Currently, available habitat lacks vegetative cover and only provides escapement cover in the riprap. This has resulted in a low HSI value of 0.16 and net loss of 14 HU's.

Sharp-tailed Grouse – Sharp-tailed grouse shrub-steppe habitat included 531 acres with a value of 0.85 and wintering riparian habitat of 21 acres with HSI- 0.74 pre-construction. A total 313 acres of sharp-tailed grouse shrub-steppe habitat are currently available with an HSI=0.72 and winter riparian habitat of 11 acres with a very low HSI value of 0.1. This results in a combined loss of 240 HU's.

Sage Grouse – Original shrub-steppe habitat included 531 acres of sage grouse habitat with an HSI value of 0.48. A total of 313 acres of sage grouse habitat remain with a value of 0.13, which resulted in a net loss of 214 HU's of sage grouse habitat.

Mule Deer – The original mule deer habitat included 531 acres of shrub-steppe with HSI-0.71 and 13 acres of mixed forest habitat with an HSI-0.81. Currently 313 acres of mule deer shrub-steppe habitat remains with a much lower HSI value of 0.29. The mixed forest area was destroyed with the original dam construction. The combined loss was 297 mule deer HU's.

Spotted Sandpiper – The former sand/gravel/cobble habitat for spotted sandpipers included 48 acres with a value of 0.85 and island habitat of one acre with HSI=1.0. After dam construction the area of sand/gravel/cobble was reduced to 31 acres and much of it riprapped, which resulted in a lower HSI value of 0.59. A four-acre island was created with an HSI-0.50. The nesting distance to water was the limiting factor in spotted sandpiper habitat in this area. The overall net loss was 22 spotted sandpiper HU's.

Ring-necked Pheasant – The agricultural areas were originally in orchard, hay or cereal grains with significant amounts of edges and field borders. Forty-eight acres of habitat had an HSI value of 0.64. These areas are now in grass and orchard with less cover and lower values for reproduction. Although the acreage has increased to 71 acres, the HSI value has dropped to 0.37. This resulted in a net loss of 4.45 HU's for the ring-necked pheasant.

Canada Goose – The island/sandbar habitat rated high because it satisfied the life requirements of the Canada goose. The small rock islands in the area totaled one acre and had an HSI=0.89. After dam construction a four-acre island was created (the "Button-Hook"), but the HSI value dropped to 0.55 because of the location and inability of the broods to reach open water. As a net result the Canada goose gained 1.31 HU's, which indicates how important this type of habitat is to wildlife.

Bobcat – The original rock outcrop where the dam now sits contained 25 acres of bobcat habitat with a moderate HSI value of 0.65. That area now has been developed which resulted in a loss of 16 HU's of bobcat habitat.

Lewis' Woodpecker - The mixed forest habitat type had a moderately high rating of HSI-0.74 for the 13 original acres. Dam construction destroyed all the mixed forest habitat and resulted in a loss of 10 HU's for the Lewis' woodpecker.

Yellow Warbler - This non-game bird uses scrub-shrub habitat associated with wetlands around small ponds for its life requirements. The mouth of Foster Creek supplied three acres of this habitat with an HSI value of 0.63. This habitat has been destroyed. However, the borrow pits on the Okanogan side of the river filled with seepage from the Columbia River and formed three acres of yellow warbler habitat with an HSI-0.18. This low value is the result of the area lacking vegetative cover and hydrophytic shrubs. The net result was one HU lost to the yellow warbler.

Table 4. Wildlife Habitat Units Lost/Gained on Non-Inundated Areas Affected by Construction of Chief Joseph Dam

Habitat Type	Pre-Constr. Habitat Units Value	Current Habitat Units Value	Net Change
1. Riverine (flowing river)			
Mink	17.68	4.16	-13.52
2. Shrub-steppe			
Sharp-tailed Grouse	451.35	225.36	-225.99
Sage Grouse	254.88	40.69	-214.19
Mule Deer	377.01	90.77	-286.24
3. Sand/Gravel/Cobble			
Spotted Sandpiper	40.80	18.29	-22.51
4. Riparian/Macrophyllus Draws			
Sharp-tailed Grouse	15.54	1.10	-14.44
5. Agriculture			
Ring-necked Pheasant	30.72	26.27	-4.45
6. Island/Sandbar			
Canada Goose	0.89	2.20	+1.31
Spotted Sandpiper	1.00	2.00	+1.00
7. Rock			
Bobcat	16.25	0.00	-16.25
8. Mixed Forest			
Lewis' Woodpecker	9.62	0.00	-9.62
Mule Deer	10.53	0.00	-10.53
9. Palustrine (ponds, slackwater)			
Yellow Warbler	1.89	0.54	-1.35

The cumulative impacts to wildlife as a result of the original construction and operation of Chief Joseph Dam are summarized in Table 5.

Table 5. Total Wildlife Habitat Units Lost and Gained by Indicator Species Caused by the Construction and Operation of the Chief Joseph Dam

Net Habitat Units Gained

Lesser Scaup	+1440.00

Net Habitat Units Lost

Sharp-tailed Grouse	-2290.10
Mule Deer	-1992.12
Spotted Sandpiper	-1254.46
Sage Grouse	-1179.13
Mink	- 920.40
Bobcat	- 400.70
Lewis' Woodpecker	- 286.04
Ring-necked Pheasant	- 238.69
Canada Goose	- 213.18
Yellow Warbler	- 58.05

CHIEF JOSEPH WILDLIFE HITIGATION OBJECTIVES

Consistent with the NPPC's Wildlife Rule developed in 1989, generic wildlife mitigation objectives based upon identifiable losses were developed. Non-tribal and tribal mitigation objectives (Table 6) were developed from several sources. These sources included public hearings and written comments as well as discussion between members of the Chief Joseph Wildlife Mitigation Technical Work Group. Also considered were the NPPC (1987) sub-basin goals, local wildlife needs identified during the study (Giles, 1971; and USDE, 1985), and the policies and goals of WDW and CCT.

Once these indicator species are prioritized, they are presented as target species for mitigation. Future mitigation efforts will then focus on the habitats represented by the target species.

Following are WDW and CCT wildlife mitigation objectives for the target species listed in priority order. Also listed are the common names of the species anticipated to benefit from these mitigation actions.

WDW Prioritized Wildlife Mitigation Objectives

1. Protect, develop or replace 1145 habitat units of sharp-tailed grouse habitat to address shrub-steppe, rockland, and riparian losses resulting from Chief Joseph Dam.

Species anticipated to benefit include sharp-tailed grouse, sage grouse, sage sparrow, downy woodpecker, northern oriole, pygmy rabbit, burrowing owl, and white-tailed jackrabbit.

2. Protect, develop, or replace 590 habitat units of sage grouse habitat to address rockland and shrub-steppe losses resulting from Chief Joseph Dam.

   Species anticipated to benefit include sage grouse, sharp-tailed grouse, pygmy rabbit, sage sparrow, sage thrasher, loggerhead shrike, sage vole, sagebrush lizards, white-tail jackrabbit, ferruginous hawk, Merriam's shrew, burrowing owl, and short-eared owl.

3. Protect, develop, or replace 29 habitat units of yellow warbler habitat to address palustrine scrub-shrub losses resulting from Chief Joseph Dam.

   Species anticipated to benefit include yellow warbler, eastern and western kingbird, black-capped chickadees, pallid bat, western pipistrelle, long-legged bat, wood duck, great blue heron, Sylvan hairstreak butterfly, and viceroy butterfly.

4. Protect, develop, or replace 107 habitat units of Canada goose habitat to address island/sandbar losses resulting from Chief Joseph Dam.

   Species anticipated to benefit include Canada goose, shorebirds, gulls, terns, wading birds and waterfowl.

5. Protect, develop, or replace 119 habitat units of ring-necked pheasant wintering habitat to address agricultural losses resulting from Chief Joseph Dam.

   Species anticipated to benefit include ring-necked pheasant, California quail, Swainson's hawk, mourning dove, cottontails, western kingbird, meadowlark, northern harrier, gyrfalcon and red-tailed hawk.

6. Protect, develop, or replace 143 habitat units of Lewis' woodpecker habitat to address ponderosa pine savanna and mixed forest losses resulting from Chief Joseph Dam.

   Species anticipated to benefit include Lewis' woodpecker, osprey, bald eagles, ruffed grouse, sharp-shinned hawk, Cooper's hawk, sapsuckers, western bluebird, tree squirrels, pileated woodpecker, goshawk, bats, and cavity nesters.

7. Protect, develop, or replace 460 habitat units of mink habitat to address riverine/riparian losses resulting from Chief Joseph Dam.

   Species anticipated to benefit include mink, river otter, beaver, muskrat and riparian wildlife.

8. Protect, develop, or replace 996 habitat units of mule deer winter range to address mixed forest, ponderosa pine savanna, shrub-steppe and rockland losses resulting from Chief Joseph Dam.

Species anticipated to benefit include mule deer, sharp-tailed grouse, sage grouse, pygmy rabbit, loggerhead shrike, cavity nesters, and passerine birds.

9. Protect, develop, or replace 200 habitat units of bobcat habitat to address rock and rockland losses resulting from Chief Joseph Dam.

   Species anticipated to benefit include bobcat, golden eagle, yellow-bellied marmot, cottontail, bushy-tailed wood rat, great horned owl, porcupines, pocket mice and voles.

10. Protect, develop, or replace 627 habitat units of spotted sandpiper habitat to address the sand/gravel/cobble losses resulting from Chief Joseph Dam.

    Species anticipated to benefit include spotted sandpiper, great blue heron, sandhill crane, avocet, phalarope, Canada goose, mourning doves, gulls, terns, shorebirds, waterfowl and wading birds.

Emphasis of mitigation would be on permanent protection and/or enhancement of the respective habitat types lost or affected by the original construction of Chief Joseph Dam.

CCT Prioritized Wildlife Mitigation Objectives

1. Protect, develop or replace 996 habitat units of mule deer winter range to address shrub-steppe/rockland, mixed forest/ponderosa pine losses resulting from Chief Joseph Dam.

   Species anticipated to benefit include mule deer, sage grouse, sharp-tailed grouse, yellow warbler, downy woodpecker, northern oriole, burrowing owl, short-eared owl, golden eagle, badger, bobcat, coyote and native grasses, forbs and shrubs.

2. Protect, develop or replace 1145 habitat units of sharp-tailed grouse habitat to address shrub-steppe/rockland and riparian/macrophyllous draws losses resulting from Chief Joseph Dam.

   Species anticipated to benefit include sharp-tailed grouse, sage grouse, mule deer, yellow warbler, downy woodpecker, northern oriole, burrowing owl, short-eared owl, golden eagle and native vegetation of the shrub-steppe community.

3. Protect, develop or replace 590 habitat units of sage grouse habitat to address shrub-steppe losses resulting from Chief Joseph Dam.

   Species anticipated to benefit include sage grouse, mule deer, sharp-tailed grouse, yellow warbler, downy woodpecker, northern oriole, burrowing owl, short-eared owl, golden eagle and native vegetation of the shrub-steppe community.

4. Protect, develop or replace 107 habitat units of island habitat for nesting Canada geese to address loss of island habitat resulting from Chief Joseph Dam.

   Species anticipated to benefit include Canada goose, gulls, Caspian, Forster's, common and black terns, shorebirds, mallards, and common loon.

5. Protect develop or replace 200 habitat units of rock and rockland habitat for bobcat to address losses resulting from the Chief Joseph Dam.

   Species anticipated to benefit include bobcat, yellow-bellied marmot, bushy-tailed woodrat, cotton-tail rabbit, quail, golden eagle and associated vegetation.

6. Protect develop or replace 460 habitat units of riverine habitat for mink to address losses resulting from Chief Joseph Dam.

   Species anticipated to benefit include mink, beaver, muskrat, otter, flicker, pallid bat, long-eared owl, great blue heron, Sylvan hair-streak butterfly, Viceroy butterfly, water shrews, and black bear.

7. Protect develop or replace 29 habitat units of palustrine habitat for yellow warbler to address losses resulting from Chief Joseph Dam.

   Species anticipated to benefit include yellow warbler, western kingbird, various song birds, small mammals, and yellow-headed blackbird.

8. Protect develop or replace 143 habitat units of mixed forest and ponderosa pine savanna habitats for Lewis' woodpecker to address the losses resulting from Chief Joseph Dam.

   Species anticipated to benefit include Lewis' woodpecker, and red squirrel.

9. Protect develop or replace 119 habitat units of agriculture habitat for ring-necked pheasant to address losses resulting from the Chief Joseph Dam.

   Species anticipated to benefit include ring-necked pheasant, quail, grey partridge, dove, cottontail rabbit, western kingbird, meadowlark, northern harrier, and red-tailed hawk.

10. Protect develop or replace 627 habitat units of sand/gravel/cobble habitat for spotted sandpiper to address losses resulting from the Chief Joseph dam.

    Species anticipated to benefit include spotted sandpiper, avocet, phalarope, and sandhill crane.

Emphasis of mitigation would be on permanent protection and/or enhancement of the respective habitat types lost or affected by the original construction of Chief Joseph Dam.

Table 6. Prioritized Wildlife Mitigation Objectives

Washington Department of Wildlife

Target Species	Target Habitat	Habitat Units 1/
Sharp-tailed Grouse	Shrub-steppe/riparian draws	1145.05
Sage Grouse	Shrub-steppe	589.57
Yellow Warbler	Ponds/slackwater	29.03
Canada Goose	Islands/sandbar	106.59
Ring-necked Pheasant	Agriculture	119.34
Lewis' Woodpecker	Ponderosa pine/mixed forest	143.02
Mink	Riverine	460.20
Mule Deer	Shrub-steppe/mixed forest	996.06
Bobcat	Rock/rockland	200.35
Spotted Sandpiper	Sand/gravel/cobble	627.23

Colville Confederated Tribes

Target Species	Target Habitat	Habitat Units
Mule Deer	Shrub-steppe/mixed forest	996.06
Sharp-tailed Grouse	Shrub-steppe	1145.05
Canada Goose	Island/sandbar	106.59
Sage Grouse	Shrub-steppe	589.57
Bobcat	Rock/rockland	200.35
Mink	Riverine	460.20
Yellow Warbler	Ponds/slackwater	29.03
Lewis' Woodpecker	Ponderosa Pine/mixed forest	143.02
Ring-necked Pheasant	Agriculture	119.34
Spotted Sandpiper	Sand/gravel/cobble	627.23

1/ These figures reflect the combined loss of respective wildlife habitat that resulted from land loss due to inundation and uplands affected by original construction of Chief Joseph Dam.

HYDROELECTRIC RESPONSIBILITY FOR WILDLIFE LOSSES

The Power Act requires that mitigation for wildlife losses be undertaken for "hydroelectric projects" having "various project purposes" (Section 4(h) (10) (C). Congress stated that "monetary cost resulting from implementation of the (mitigation) program are to be allocated among projects, both Federal and non-Federal, in accordance with the relative impacts...."

The NPPC (1987) subsequently determined that funding authority for wildlife mitigation would be limited to Federal projects only, and to just one part of those Federal projects--the power purpose. Chief Joseph Dam is operated for 98 percent power generation and 2 percent water storage for irrigation.

The wildlife habitat losses identified in this report are attributable to the changes in wildlife habitat which occurred as a direct result of the construction and operation of Chief Joseph Dam, powerhouse, support facilities, and the creation of the Rufus Woods Lake.

POTENTIAL FUTURE MITIGATION AVENUES TO ADDRESS WILDLIFE HABITAT LOSSES

Following the completion of this loss assessment and development of wildlife mitigation objectives, the NPPC will consider, for amendment to the Wildlife Rule, the loss statements and mitigation objectives of this study. Mitigation, based upon HEP, calls for replacing a lost habitat unit with another habitat unit (Federal Register, 1981), rather than simply replacing acre for acre. More than one species may share a habitat unit.

Future mitigation options can include, but are not limited to, the following actions:

1) Conduct management activities to increase habitat values of existing COE project lands and nearby public lands;
2) Lease and enhance private land habitat;
3) Intergovernmental cooperative management agreements;
4) Acquisition of perpetual conservation easements;
5) Acquisition of land in fee and permanent enhancement.

Future mitigation for the original construction of Chief Joseph Dam could include a number of options; however, land condemnation will not be one of them.

Subsequent to NPPC's amendment of the wildlife habitat losses for Chief Joseph Dam determined in this study, wildlife mitigation planning can commence to begin addressing identified impacts. The use of existing COE's land, as well as other private and public lands, will be thoroughly evaluated at that time. Such an analysis was outside the scope of this study.

SUMMARY

Pre- and post-construction and current habitat conditions associated with the COE's Chief Joseph Hydroelectric Project in north-central Washington were evaluated using the USFWS's Habitat Evaluation Procedures. The project directly impacted 8822 acres of terrestrial and riverine wildlife habitat. This resulted in significant losses of habitats needed to support a diverse and significant wildlife resource. Eleven wildlife habitat indicator species were selected to evaluate the impacts to wildlife and wildlife habitat. Losses and gains for each wildlife indicator species are expressed in Habitat Units. One HU is equivalent to one acre of optimum habitat for that indicator species. The assessment estimated that losses of 920 HU's of mink habitat, 2290 HU's of sharp-tailed grouse habitat, 1179 HU's of sage grouse habitat, 1254 HU's of spotted sandpiper habitat, 239 HU's of ring-necked pheasant habitat, 286 HU's of Lewis' woodpecker habitat, 213 HU's of Canada goose habitat, 401 HU's of bobcat habitat, 58 HU's of yellow warbler habitat, and 1992 HU's of mule deer habitat occurred as a result of the total impacts from the original construction and operation of Chief Joseph Dam, for a combined loss of 8832 HU's. This total includes inundated and non-inundated areas affected by the construction of Chief Joseph Dam. Conversely, Chief Joseph Dam created an additional 7926 acres of open water habitat which resulted in a gain of 1440 habitat units for the lesser scaup. A total of 337 acres of island/sandbar habitat was lost, including 6 larger islands and 688 smaller islands, while 100 acres of new islands were created. Habitat unit estimates for the Canada goose and spotted sandpiper reflect the net impacts.

Prioritized tribal and non-tribal wildlife mitigation objectives were also developed for the target wildlife species.

The emphasis of the study was to involve local and elected officials, as well as other interested parties. A major public outreach effort included extensive interviews with local residents and wildlife experts to gain background on the wildlife and current needs. Three public meetings were held in the area during the year-long planning study to keep interested parties informed. A Chief Joseph Public Review Document was widely circulated for written input on the wildlife loss statements and associated mitigation objectives.

The Chief Joseph Interagency Technical Work Group provided technical direction and assisted with field activities.

The Grand Coulee/Chief Joseph Wildlife Mitigation Steering Committee was established to represent local input and concerns with the planning and implementation process. It includes local government, environmental groups, sportsmen's groups, cattlemen, wheatgrowers, Indian tribes, and local electric utilities.

The project was coordinated through the Bonneville Power Administration, the Northwest Power Planning Council, and the U.S. Army Corps of Engineers.

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APPENDIX A

Chief Joseph Dam Wildlife Mitigation Work Groups

Grand Coulee/Chief Joseph Wildlife Mitigation Steering Committee

The Steering Committee was established to represent local input and concerns with the planning and implementation process.

Local Utilities	Ralph Byre
Wheatgrowers (Lincoln County)	Hal Johnson
(Douglas County)	Lee Hemmer
Cattlemen (Lincoln County)	Keith Nelson
(Douglas County)	Allan Miller
Colville Confederated Tribes	Steve Judd
Upper Columbia United Tribes	Chris Merker
Conservation Groups (Ephrata Sportsmen's Club)	Don Galbreath
Sportsman/Landowner	David Stevens
Environmental Groups (WA Environmental Council and the Nature Conservancy)	Larry Hampton
Local Government (Stevens County)	Allan Mack
(Stevens County)	Tom McKern
(Douglas County)	Jay Weber

Chief Joseph Interagency Technical Work Group

The Technical Work Group's function was to assist with field activity and provide technical direction and input for the project.

Northwest Power Planning Council (NPPC)	Peter Paquet
Bonneville Power Administration (BPA)	Joe DeHerrera
Bureau of Land Management (BLM)	Neal Hedges
U.S. Fish and Wildlife Service (USFWS)	Tim Bodurtha
U.S. Army Corps of Engineers (COE)	Bob Fischer
	Ken Brunner
Colville Confederated Tribes (CCT)	Steve Judd
	Matt Berger
Pacific Northwest Utilities Conference Committee (PNNUC)	*
Upper Columbia River Counties (UCRC)	Jay Weber
Washington Department of Wildlife (WDW)	Tracy Lloyd
	Mike Kuttel
	Doug Kuehn

* PNNUC was invited to participate in the Technical Work Group, although they elected not to participate were kept informed of the study's progress.

Appendix A (Cont.)

Chief Joseph Habitat Evaluation Procedure Field Team

The HEP Team measured wildlife habitat variables for each of the indicator species in the study area.

HEP Member	Affiliation
Tim Bodurtha	USE-US
Bob Fischer	COE
Jim Habermehl	COE
David Stevens	GC/CJ SC
Steve Judd	CCT
Maureen Murphy	CCT
Kathy Cushman	CCT
Bill Gardner	CCT
Cliff Martin	CCT
Matt Berger	CCT
Mike Kuttel	WDW
Ginna Correa	WDW
Marc Hallet	WDW
Doug Kuehn	WDW

APPENDIX B

PUBLIC OUTREACH SUMMARY
GRAND COULEE/CHIEF JOSEPH DAM WILDLIFE MITIGATION

The following list includes presentations, meetings, and consultations with individuals, agencies, and state/local elected officials. News releases, newspaper editorials, brochures, and television coverage were used whenever possible to enhance the effectiveness of the Public Outreach Program.

- 2-89 Briefing to membership of Lake Roosevelt Forum.
- 4-05-89 Briefing to representatives of Washington Department of Community Development.
- 4-11-89 Briefing to representatives of Washington Quail Unlimited organization.
- 4-21-89 Briefing to membership of Lake Roosevelt Forum.
- 4-24-89 Consultation with Montana NPPC member John Brenden.
- S-05-89 Consultation with Washington NPPC member Ted Bottiger.
- 5-25-89 Briefing to representatives of Ephrata Sportsmen Club.
- 6-05-89 Briefing to Washington Department of Wildlife's Wildlife Advisory Council.
- 6-07-89 Briefing to Washington Wildlife Commission, telephone conference.
- 8-12-89 Briefing before Washington Wildlife Commission.
- 8-30-89 Consultation with Washington NPPC member Tom Trulove and Lake Roosevelt Forum.
- 9-05-89 Spokane Columbia River Wildlife Mitigation Public Outreach meeting.
- 9-06-89 Wenatchee Columbia River Wildlife Mitigation Public Outreach meeting.
- 9-07-89 Yakima Columbia River Wildlife Mitigation Public Outreach meeting.
- 9-11-89 Vancouver Columbia River Wildlife Mitigation Public Outreach meeting.
- 9-13-89 Seattle Columbia River Wildlife Mitigation Public Outreach meeting.

- 9-15-89 Briefing of House Natural Resources and Parks Committee of Washington Legislature.

- 10-24-89 Briefing of Washington State Senator Scott Barr, local residents, and elected officials in the vicinity of Davenport.

- 11-03-89 Briefing of Senate Environmental and Natural Resources Committee of Washington Legislature.

- 11-22-89 Briefing to Washington State Representative Steve Fuhrman, local residents, and elected officials in the vicinity of Kettle Falls.

- 11-30-89 Consultation with major agencies and tribes on draft Grand Coulee Dam wildlife mitigation goals and the Power Planning process (National Park Service, Bureau of Reclamation, U.S. Fish and Wildlife Service, Colville Tribe, Spokane Tribe, and NPPC staff).

- 12-15-89 Public review document regarding Grand Coulee Wildlife Mitigation Plan and prioritized goals made available to local government using DCD Intergovernmental Review Process.

- 1-08-90 Consultation with The Nature Conservancy on Columbia River wildlife mitigation.

- 1-15-90 Public review document regarding Grand Coulee Wildlife Mitigation Plan and prioritized goals. Mailed to over 700 individuals and organizations statewide with a 30-day written input period.

- 1-20-90 Consultation with local public and government and conservation/environmental groups in Chewelah. In cooperation with local and state elected officials, the Grand Coulee Wildlife Mitigation Advisory Group was established, consisting of approximately 50 members.

- 2-07-90 Local government/Grand Coulee Advisory Group consultation to collect formal input on Grand Coulee mitigation goals and to provide background information on the loss statement and Columbia River mitigation planning process.

- 2-12-90 Davenport public hearing to obtain formal input on Grand Coulee mitigation goals and to provide background information on the loss statement and Columbia River mitigation planning process.

- 2-13-90 Kettle Falls public hearing to obtain formal input on Grand Coulee mitigation goals and to provide background information on the loss statement and Columbia River mitigation planning process.

3	3-22-90	Grand Coulee Wildlife Mitigation Advisory Group meeting. Grand Coulee Wildlife Mitigation Steering Committee created as a five-member subset of the Advisory Group.
0	4-16-90	Grand Coulee Wildlife Mitigation Steering Committee meeting.
0	4-18-90	Consultation with Ephrata Sportsmen Association on Columbia River wildlife mitigation and Banks Lake.
0	S-14-90	Grand Coulee Wildlife Mitigation Steering Committee meeting.
0	S-29-90	Consultation with BPA on preliminary Grand Coulee wildlife mitigation strategies.
0	6-04-90	Lincoln County Wheat Growers meeting in Harrington.
0	6-06-90	Consultation with BPA on Chief Joseph Dam mitigation planning study "Statement of Work."
0	6-07-90	Meeting with BLM concerning wildlife management strategies on BLM property in Lincoln County.
o	6-11-90	Grand Coulee Wildlife Mitigation Steering Committee meeting.
o	6-13-90	Briefing to Davenport Conservation District Board.
o	6-19-90	Demonstration project briefing with Lee Smith, WDW legislative representative.
0	6-21-90	Consultation with Lincoln County Commissioner Andy Rustemeyer concerning the demonstration project.
0	6-25-90	Consultation with BLM area office staff concerning a tour of potential public-owned mitigation sites.
0	6-28-90	Briefing to Ed Menning, National Park Service, Seattle, concerning National Park participation in Grand Coulee wildlife mitigation.
o	7-02-90	Briefing to Lincoln County Commissioners in Davenport.
o	7-12-90	Toured BLM lands in Lincoln County.
o	7-16-90	Conducted a tour of Lincoln County shrub-steppe habitat with BPA representatives.
0	7-26-90	Briefed the Davenport Chamber of Commerce on project history, project objectives and goals, and estimated program costs.
0	7-27-90	Consultation with BPA representatives concerning project advance design requirements.

o	7-31-90	Briefed the NPPC Wildlife Advisory Committee on WDW mitigation efforts, shrub-steppe habitat, and the WDW Public Outreach Program.
o	8-02-90	Grand Coulee Wildlife Mitigation Steering Committee meeting.
o	8-03-90	Consultation with BLM representatives and toured BLM properties for potential inclusion into current mitigation strategies.
o	8-07-90	Consultation with Wildlife Scoping Group concerning project prioritization.
o	9-06-90	Briefing to Stevens County Commissioner Allan Mack.
o	9-10-90	Grand Coulee Wildlife Mitigation Committee meeting.
o	9-14-90	Consultation with NPPC members Bottiger and Trulove on Columbia River wildlife mitigation, the implementation process, and WDW Grand Coulee mitigation project proposals.
o	9-27-90	Consultation with PNUCC and WDW representatives to develop a HEP model for pygmy rabbits.
o	10-11-90	Consultation with NPS representative Karen Taylor Goodrich.
o	10-15-90	Consultation with EWU Research Unit Biologists Chris Merker and Tom Stralser.
o	10-22-90/ 10-25-90	Tracy Rock field measurements for HEP. Individuals representing UCUT, CCT, WDW, BLM, SCS, NPPC, YIN, USBR, NPS, EWU, Lincoln County Commissioners, and private landowners participated in the HEP analysis.
o	11-13-90	Briefing with Grand Coulee Steering Committee concerning HEP evaluation results.
o	12-04-90	Consultation with NPS, peregrine fund, BOR regarding Lake Roosevelt mitigation proposal to reestablish peregrine falcon.
o	12-07-90	Briefing with Tracy Rock area landowners regarding results of the HEP process.
o	12-10-90	Submitted outline of Chief Joseph Wildlife Mitigation Planning Study to the Department of Community Development for inclusion in the Washington intergovernmental review process (Federal Clearing House Process).
o	12-13-90	Discussed status of project with Lincoln County Commissioner Andy Rustemeyer.
o	l-03-91	Grand Coulee/Chief Joseph Wildlife Mitigation Steering Committee meeting.

- 1-10-91 Meeting with Harold Roloff (landowner) and John Martin (TWC).
- 1-15-91 Consultation with NPPC member Bottiger on Public Outreach Program for Columbia River wildlife mitigation.
- 1-31-91 Consultation with Andy Rustemeyer.
- 2-01-91 Beginning of Chief Joseph Dam Wildlife Mitigation Planning Study. WDW as lead agency for BPA-funded study.
- 2-07-91 Consultation with BPA on predesign contract elements for Lincoln County sharp-tailed grouse and Douglas County Pygmy Rabbit Project proposals (Grand Coulee mitigation).
- 2-21-91 First meeting of Chief Joseph Wildlife Mitigation Planning Study Interagency Technical Working Group. Members include WDW, CCT, NPPC, BPA, PNUCC, COE, USFWS, BLM, and UCRC.
- 3-01-91 Began interviews with local landowners in the Chief Joseph study area: Lee and Joan Hanford, Paul Benson, Tex Troutman, Charles and Sharon Hammon.
- 3-05-91 Meeting with Douglas County Wheat Growers Association. Reviewed the status of Columbia River wildlife mitigation.
- 3-06-91 Grand Coulee/Chief Joseph Wildlife Mitigation Steering Committee meeting.
- 3-08-91 Interviews about study area with Melvin and Shine Thoren, and Lee Hemmer, landowners, Douglas County.
- 3-12-91 Consultation with BPA concerning components of WDW statement of work for Tracy Rock sharp-tailed grouse proposal and Douglas County Pygmy Rabbit Project.
- 3-18-91 Briefing with Dave Dormaier (Douglas County landowner) and Douglas County SCS representatives regarding pygmy rabbit management plans and conservation easement terms.
- 3-21-91 Briefing with Douglas County Steering Committee members regarding the status of the Columbia River Mitigation Program.
- 4-04-91 Meeting with COE, reviewed Rufus Woods Lake and mitigation sites for ten-foot pool rise.
- 4-08-91 Chief Joseph Wildlife Mitigation Planning Study Interagency Technical Working Group meeting.
- 4-10-91 Chief Joseph Project Biologists join COE for trip to Bailey Basin and Buckley Bar on Rufus Woods Lake.
- 4-10-91 Chief Joseph Project Biologists gave an update to the Ephrata Sportsmen Club about the project.

- 4-17-91 Chief Joseph Wildlife Mitigation Planning Study public meeting in Bridgeport.
- 4-25-91 Meeting with Melba Cannon and Shine Thoren; discussed "Bridgeport: A Collection of Memories."
- 4-30-91 Project Biologists' meeting in Olympia with USFWS to go over HEP models and target species.
- S-01-91 Project Biologists reviewed original land survey notes of Chief Joseph Study area at Department of Natural Resources, Olympia.
- S-06-91 Grand Coulee pre-design contract begins; funded by BPA.
- S-08-91 Chief Joseph Wildlife Mitigation Planning Study Interagency Technical Working Group meeting, and tour of Rufus Woods Lake.
- S-09-91 Project Biologists, USFWS, and COE looked at staging areas, spoil piles, and started planning HEP in field.
- S-15-91 Project Biologists went to Waterville Soil Conservation Service, Douglas County Courthouse, and Waterville Museum.
- S-30-91 Grand Coulee/Chief Joseph Wildlife Mitigation Steering Committee meeting, Spokane.
- 6-03-91 through 6-06-91 Contacted 30 local landowners for permission to enter their land for HEP study.
- 6-06-91 Project Biologists met with COE and USFWS; did preliminary HEP field work.
- 6-10-91 through 6-18-91 Chief Joseph Wildlife Mitigation Habitat Evaluation Procedure field study.
- 7-10-91 Grand Coulee/Chief Joseph Wildlife Mitigation Advisory Group meeting.
- 7-16-91 Project Biologists met with COE to discuss aerial photographs of non-inundated (affected) areas.
- 7-30-91 through 7-31-91 Chief Joseph Wildlife Mitigation HEP grab samples on Rufus Woods Lake.
- 8-09-91 Talked to Dick Thompson, retired Game Protector, Department of Game, Electric City.
- 8-21-91 Chief Joseph Wildlife Mitigation Technical Working Group meeting, Ephrata.

- 9-03-91 Talked to Jack Wells, landowner, Okanogan County.
- 9-06-91 Project Biologists met with Jay Weber (Douglas County Commissioner) and later interviewed Harold Weber (longtime area resident landowner); and interviewed principal Ray Gilman at Wright Elementary School.
- 9-11-91 Project Biologists gave an update of the study to Ephrata Sportsmen Club, Ephrata.
- 9-13-91 Interviewed George Thalheimer, landowner, Okanogan County.
- 9-24-91 Second Chief Joseph Wildlife Mitigation Study public meeting, Wright Elementary School, Coulee Dam.
- 9-25-91 Project Biologists met with COE personnel, Bridgeport, to address comments received at public meeting.
- 9-25-91 Douglas County Steering Committee meeting, Mansfield.
- 10-07-91 Project Biologists interviewed Cecil and Eleanor Trefry, Hanson longtime residents of Trefry Canyon in the study area.
- 10-07-91 through 10-08-91 Chief Joseph Wildlife Mitigation HEP study for impacted areas around Chief Joseph Dam.
- 10-08-91 Consultation with COE regarding potential future mitigation lands surrounding Chief Joseph Dam and Rufus Woods Lake.
- 10-08-91 Briefing Lee Hemmer, landowner, and Wheat Growers Association, Douglas County.
- 10-23-91 Mailed draft report for Chief Joseph Wildlife Mitigation Study to Technical Working Group members.
- 10-30-91 Chief Joseph Interagency Technical Work Group meeting, Ephrata.
- 11-01-91 Grand Coulee/Chief Joseph Wildlife Mitigation Steering Committee meeting, Spokane.
- 11-05-91 Mailed revised draft report for Chief Joseph Wildlife Mitigation Study to Technical Work Group members for comments.
- 11-20-91 Wildlife mitigation presentation in Sandpoint, Idaho at annual BPA contract coordination meeting.
- 11-23-91 Over 600 copies of draft report "Wildlife Habitat Impact Assessment Chief Joseph Dam Project" distributed to interested parties for comment.

- 11-25-91 Consultation with COE and Douglas County Commissioners, Waterville, on Chief Joseph Dam study and Columbia River mitigation under the Power Act.

- 12-03-91 Grand Coulee/Chief Joseph Wildlife Mitigation Steering Committee meeting, Spokane.

- 12-09-91 Project Biologists met with Grant County Public Utility District, Ephrata, to discuss Chief Joseph Dam Project draft report.

- 12-11-91 Final public hearing on Chief Joseph Wildlife Mitigation Study conducted at Bridgeport to gather formal input on wildlife habitat losses and mitigation objectives.

- 12-16-91 Consultation with Ephrata Sportsmen Club member regarding non-tribal priority objectives.

- 01-06-92 End of formal comment period for Chief Joseph Wildlife Mitigation Study.

- 01-15-92 Project Biologists complete response to comments on the draft circulated for review.

- 01-21-92 Consultation with NPPC regarding Chief Joseph Loss Assessment, mitigation objectives and associated public outreach effort.

- 01-31-92 Submittal for Final Report "Wildlife Habitat Impact Assessment Chief Joseph Dam Project".

APPENDIX C
Flora and Fauna Associated with the Study Area

The following materials are reprinted from:

Erickson, et al., 1976
Foster, et al., **1982**

APPENDIX C-l

Spring species list and relative abundance of plants in the Rufus Woods Lake Study area.

Plant species	Status P=Perennial A=Annual	Habitat and Plant Abundance[a] Shrub-steppe	Rock	Rockland	Coniferous-forest	Coniferous tree over shrub layer	Macrophyllous vine and shrub	Broadleaf tree over shrub layer	Riparian	Mixed coniferous and broadleaf trees over shrub layer	Buckley Bar	Short's Island	Goose Island	Park Island	Lone Pine Island
Trees															
Ponderosa pine (Pinus ponderosa)	P		-		3	4	-	-	-	4-5	1	-	-		1
Mountain alder (Alnus incana)	P	-	-					2-3	-	3					
Quaking aspen (Populus tremuloides)	P		-					1-2	-						
Rocky Mountain juniper (Juniperus scopulorum	P	-	-					1	-	1	2	1	-		
Water birch (Betula occidentalis)	P	-	-					3-4	1	3					
Douglas fir (Pseudotsuga menziesii)	P		-		2-3				-	2					
Black cottonwood (Ponulus trichocarpa)	P	-	-					0	-						
Shrubs															
Wyeth buckwheat (Eriogonum heracleoides	P	3	2	3	2-3		2	-	-	-	1	-	-	1	
Big sagebrush (Artemisia tridentata)	P	4-5	5	3-4			2-3	1-2	-	1				3	4-5
Sulfur lupine (Lupinus sulphureus)	P	2-3	-						-	-				1[b]	
Bitterbrush (Purshia tridentata)	P	3-C	3	3	3	3	3	-	-	2	5	-	1	5	
Green rabbitbrush (Chrysothamnus viscidiflorus)	P	2	-	1					-	-					
Smooth sumac (Rhus glabra)	P	2	-			2	3	2	-	-	2	-	-		2
Snow buckwheat (Eriogonum niveum)	P	3	-	2	2		3	-	-	-				2	
Threetip sagebrush (Artemisia tripartita)	P	3	1	4	2				-	-					
Velvety lupine (Lupinus leucophyllus)	P	2	-		2-3			2	-	-					
Rabbitbrush (Chrysothamnus nauseosus)	P	3-4	-	3-4	2-3		2-3	-	-	2					

[a] Relative abundance scale: 5=abundant, 4=very common, 3=occasional to irregularly common, 2=infrequent, 1=rare. 0=single plant seen.
[b] Not classified to species.
[c] Plant species found during studies other then habitat ● tudlem.

Taken from Erickson, et al., 1976
pp. 456-467

Spring species list and relative abundance of plants in the Rufus Woods Lake Study area.

Plant species	Status P=Perennial A=Annual	Habitat and Plant Abundance[a] Shrub-steppe	Rock	Rockland	Coniferous forest	Coniferous tree over shrub layer	Macrophyllous vine and shrub	Broadleaf tree over shrub layer	Riparian	Mixed coniferous and broadleaf trees over shrub layer	Buckley gar	Short's Island	Goose Island	Park Island	Lone Pine Island
Shrubs (continued)															
Gray horsebrush (Tetradymia canescens)	P	2	1	2		-	-				-		-	-	-
Silky lupine (Lupinus sericeus)	P	3		2		-	-			2	-		-	-	-
Mockorange (Philadelphus lewisii)	P	2	3-b	2-3	1-2	3	4	3	3	2	-		-	-	-
Western virgins hover (Clematis ligusticifolia)	P	-	3-4			-	4-5	3			-		-	-	-
Serviceberry (Amelanchier alnifolia)	P	-	2-3	1	2-3	4	3	3		2	3	1	-	-	1-2
Tarragon (Artemisia dracunculus)	P	-		1	1	-	2				2	-	2	2	-
Rocky Mountain maple (Acer glabrum)	P	-			1-2	-	-		2	3	-	2	-	-	-
Squaw currant (Ribes cereum)	P	-	2	2	1-2	2	1-2	1		2	-		-	-	1
Ocean-spray (Holodiscus discolor)	P	-			2	-	1				-		-	-	-
Pearhip rose (Rosa woodsii)	P	-			2	-	3	3	2	2	2	2	-	-	1
Snowberry (Symphoricarpos albus)	P	-				-	-	3	2	4	1		-	-	-
Chokecherry (Prunus virginiana)	P	-				2	2	2-3	2	2	2		-	-	-
Tall Oregongrape (Berberis aquifolium)	P	-				2	-	3		2-3	-		-	-	-
Creasewood (Sarcobatus vermiculatus)	P	-				-	-	1-2			-		-	-	-
Willow (Salix sp.)	P	-				-	-	O-1		1	-		-	-	-
Golden currant (Ribes aureum)	P	-				-	-	1-2			-		-	-	-
Columbia hawthorn (Crataegus columbiana)	P	-				-	-	4-5		2	-	2-3	1	1	-
Siberian elm (Ulmus pumila)	P	-				-	-				-		1	0	-
Red-osier dogwood (Cornus stolonifera)	P	-				-	-	3	2		-		-	-	-
Northern buckwheat (Eriogonum compositum)	P	-				-	-	-			1		-	-	-
Herbs															
Yarrow (Achillea millifolium)	P	3	2	2-3	3	2	3	3	1	2-3	3		3	2	2
Crested wheatgrass (Agropyron cristatum)	P				3	-	-				-		-	-	-

See footnote at end of cables.

Spring species list and relative abundance of plants in the Rufus Woods Lake study area.

Plant species	Status	Habitat and Plant Abundance[a]														
	Perennial Annual	Shrub-steppe	Rock	Rock and	Coniferous forest	Coniferous tree over shrub layer	Macrophyllous shrub	Broadleaf riverine shrub	Riparian	Mixed coniferous and broadleaf trees over shrub layer	Buckeye Bar	Short Island	Goose Island	Park Island	Lone Pine Island
Herbs (continued)															
Quackgrass (Agropyron repens)[c]	P		-				-	-	-			-	-	-	
Bluebunch wheatgrass (Agropyron spicatum)	P	3	5	3-4	3	2	3	-	-	3	4	1	-	-	
Pale false dandelion (Agoseris glauca)	P	1-2	-	2	2		-	-	-			-	-	-	
Creeping bentgrass (Agrostis alba)	P		-				-	-	-			3	-	-	
Interruoted apera (Agrostis interrupta)	A		-				-	3	-			-	-	-	
Wild onion (Allium sp.)	P		-				-	-	-		1	-	-	-	
Tarweed fiddleneck (Amsinckia lycopsoides)	A		-				-	-	-		1	-	-	-	
Low pussytoes (Antennaria dimorpha)	P	1-2	-				-	-	-			-	-	-	
Rosy pussytoes (Antennaria microphylla)	P		1		2		-	-	-			-	-	-	
Spreading dogbane (Apocynum androsaemifolium)	P		-				-	2	-			-	-	-	
Sicklepod rockcress Arabis sparsiflora)	P		-		2		-	-	-	2	2	-	-	-	
Common burdock (Arctium minus)[c]	A		-				-	-	-			-	-	-	
Ballhead sandwort (Arenaria congesta var. prolifera)	P		-	1			-	-	-			-	-	-	
Twin arnica (Arnica sororia)	P		-		0-1		-	-	-			-	-	-	
Northern wormwood (Artemisia campestris)	P		-				-	-	-		2	-	-	-	
Western mugwort (Artemisia ludoviciana	P	2	-				-	-	-	2	4	3-4	5	3	i
Showy milkweed (Asclepias speciosa)	P	-	-				-	3	-			-	-	3	
Douglas' aster (Aster subspicatus)	P	-	-				-	-	-		2-3	3	-	-	
Purple milkvetch (Astragalus agrestis)	P	-	-		1-2		-	-	-			-	-	-	
Palouse milkvetch (Astragalus arrectus)	P	-	-				-	-	-	2-3		-	-	-	
Woolly-pod milkvetch (Astragalus purshii)	P	-	-				2	-	-			-	-	-	
Arrowleaf balsamroot (Balsamorhiza sagittata)	P	2	3	3	2		3	-	-	3		-	-	-	
Douglas' brodiaea (Brodiaea douglasii)	P	2	1		1-2		-	1-2	-		1	-	-	-	

See footnotes at end of table.

Spring ● peeler **list** and relative abundance of **plants in the** Rufus Woods Lake **study** area.

Plant species	Status PPerennial AAnnual	Habitat and Plant Abundance[a]														
		Shrub-steppe	Rock	Rock talus	Coniferous dry forest	Coniferous dry shrubby areas	Macrophyllous vine and shrub	Broadleaf tree over shrub layer	Riparian	Mixed coniferous and deciduous tree over shrub layer	Bare	Shrub Island	Grassland	Pasture Island	Lone Pine Island
Herbs (continued)																
Rattle grass (Bromus brizaeformis)	A						1-2		-	-	-	-	-			
Soft brome (Bromus mollis)	A				1-2			2-3	-	-	-	-	-			
Cheat grass (Bromus tectorum)	A	4-5	4	4-5	4	4	4-5	4-5	2	5	1	-	4	3		
Sego lily (Calochortus sp.)	P	2							-	-	-	-	-			
Shepherd's-purse (Capsella bursa-pastoris)[c]	A	1[b]			1[b]			1[b]	-	-	-	-	1[b]	1[b]	-	
Slenderbeaked sedge (Carex athrostachya)	P	2[b]			2[b]			3[b]	-	-	-	-	2[b]	2[b]	-	
Bebb's sedge (Carex bebbii)[c]	P	-							-	-	-	-	-			
Short-beaked sedge (Carex brevior)[c]	P	-							-	-	-	-	-			
Douglas' sedge (Carex douglasii)[c]	P	-							-	-	-	-	-			
Porcupine sedge (Carex hystricina)	P	-							2	-	-	-	-			
Woolly sedge (Carex lanuginosa)	P	-							-	-	-	1[b]	-			
Nebraska sedge (Carex nebrascensis)[c]	P	-							-	-	-	-	-			
Clustered field sedge (Carex praegracilis)[c]	P	-							-	-	-	-	1			
Knot-sheath sedge (Carex retrorsa)	P	-		t					-	-	-	-	-			
Fox sedge (Carex vulpinoidea)	P	-							-	-	-	-	-		0-1	
Whitetop (Cardaria draba)[c]	P	-							-	-	-	-	-			
Indian paintbrush (Castilleja sp.)	P	2							-	-	-	-	-			
Russian knapweed (Centaurea repens)[c]	P	-							-	-	-	-	-			
Hoary false-yarrow (Chaenactis douglasii)	P	1					1-2		-	-	-	-	-			
Lambsquarter (Chenopodium album)[c]	A	-							-	-	-	-	-	-		
Canada thistle (Cirsium arvense)	P	-						2	2-3	-	-	-	-	1-2[b]		

See footnotes **at** end of table.

Spring species list and relative abundance of plants in the Rufum Woods Lake study area.

Plant species	Status P=Perennial A=Annual	Habitat and Plant Abundance[1] Shrub-steppe	Rock	Rockland	Coniferous forest	Coniferous tree over shrub layer	Macrophyllous vine and shrub	Broadleaf tree over shrub layer	Riparian	Mixed coniferous and broadleaf trees over shrub layer	Buckley Bar	Short's Island	Goose Island	Park Island	Lone Pine Island
Herbs (continued)															
Wavy-leaved thistle (Cirsium undulatum	P		-			-	3	-	-	-	1-2	-	-	-	-
Bull thistle (Cirsium vulcare)	P		-			-	-	-	-	-		-	-	-	-
Pink fairies (Clarkia pulchella)	A		-		O-1	-	-	-	-	-		-	-	-	-
Springbeauty (Claytonia lanceolata)	P	2	-			-	-	-	-	-		-	-	-	-
Blue-eyed Mary (Collinsia parviflora)	A		-		2	-	-	2	-	-		-	-	-	-
Large-flowered collomia (Collomia grandiflora)	A		1	1-2		-	2	-	-	-	2	-	-	-	-
Bastard toad-flax (Comandra umbellata var. pallida)	P		-	1	2	-	-	-	-	-		-	-	-	-
Bindweed (Convolvulus arvensis)[C]	P	-	-			-	-	-	-	-		-	-	-	-
Columbia tickseed (Coreopsis atkinsoniana	A	2	-			-	-	-	-	-	4	3	-	-	-
Slender hawksbeard (Crepis atrabarba)	P	2	1	1	1-2	-	-	-	-	-		-	-	-	-
Gray hawksbeard (Crepis intermedia)	P	2	-			-	2	-	-	2	2-3	-	-	-	-
Obscure cryptantha (Cryptantha ambigua)	A	-	1			-	-	-	-	-		-	-	-	-
Brittle bladder-fern (Cystopteris fragilis)	P	-	-		1	-	-	-	-	-		-	-	-	-
Orchard grass (Dactylis glomerata)[C]	P	-	-			-	-	-	-	-		-	-	-	-
Upland larkspur (Delphinium nuttallianum)	P	2	-		2	-	-	2	-	2	2	-	-	-	-
Western transymustard (Descurainia pinnata)	A	-	-	1-2		-	-	-	-	2		-	1	-	-
Alkali saltgrass (Distichlis stricta)[C]	P	-	-			-	-	-	-	-		-	-	-	-
Sticky shooting star (Dodecatheon cusickii)	P	2	1		2	-	-	-	-	1-2		-	-	-	-
Spring whitlow-grass (Draba verna)	A	-	1			-	-	-	-	2		-	-	-	-
Spike-rush (Eleocharis sp.)[C]	P	-	-			-	-	-	-	-		-	-	-	-

See footnotes at end of table.

Spring species list and relative abundance of plants in the Rufus Woods Lake study area.

Plant species	Status P=Perennial A=Annual	Habitat and Plant Abundance[a] Shrub-steppe	Rock	Rockland	Coniferous forest	Coniferous tree over shrub layer	Macrophyllous vine and shrub	Broadleaf tree over shrub layer	Riparian	Mixed coniferous and broadleaf trees over shrub layer	Buckley Bar	Short's Island	Goose Island	Park Island	Lone Pine Island
Herbs (continued)															
Western ryegrass (Elymus glaucus)	P	-	-	1	1-2	-	2-3	4		3	1	-	-	-	-
Willow-herb (Epilobium sp.)	A	-	-	2-3	-	-		-		-	-	-	-	2	1
Common horsetail (Equisetum arvense)	P	-	-		-	-		2	4	3	-	-	-	-	-
Common scouring-rush (Equisetum hyemale)	P	-	-		2	-		-	2-3	2	-	-	-	-	-
Cut-leaved daisy (Erigeron compositus)	P	-	-		-	-		-		-	2	-	-	-	-
Spreading fleabane (Erigeron divergens)	P		-		-	-		-		-	-	1	2	-	-
Thread-leaf fleabane (Erigeron filifolius)	P	2-3	-		-	-		-		-	-	-	-	-	-
Desert yellow daisy (Erigeron linearis)	P	2	-	1	-	-		-			1	-	-	-	-
Philadelphia daisy (Erigeron philadelphicus)[c]	P		-		-	-		-			-	-	-	-	-
Shaggy fleabane (Erigeron pumilus)	P	2	-	2	1	-		-			-	-	-	-	-
Woolly sunflower (Eriophyllum lanatum)	P		-		-	-		-			2	-	-	-	-
Rough wallflower (Erysimum asperum)	P	2	-	-	2	-		-	-	2	1	-	-	-	-
Idaho fescoe (Festuca idahoensis)	P	4	-	2	2	3	2	-	-	2	-	1-2	-	1	-
White-stemmed frasera (Frasera albicaulis)	P		-		2	-	-	-	-		-	-	-	-	-
Blanket-flower (Gaillardia aristata)	P		-	2	1	-	-	-	-		2	2	1	-	-
Northern bedstraw (Galium boreale)	P		-		2	-	-	1-2	-	2-3	-	-	-	-	-
Sticky purple geranium (Geranium viscosissimum)	P	-	-		-	-	1	3	-	2	-	-	-	-	-
Old man's whiskers (Geum triflorum)	P	-	-		1-2	-		-	-		-	-	-	-	-
Fowl mannagrass (Glyceria striata)	P	-	-		-	-		2	-	-	-	-	-	-	-
American licorice-root (Glycyrrhiza lepidota)	A	-	-		-	-		1-2	-	-	-	-	-	-	-
Resinweed (Grindelia sp.)	P	-	-		-	-		-	-	-	-	-	-	1	-

See footnotes at end of table.

Spring species list and relative abundance of plants In the Rufus Woods Lake study area.

Plant species	Status P-Perennial A-Annual	Habitat and Plant Abundance[a] Shrub-steppe	Rock	Rockland	Coniferous forest	Coniferous tree over shrub layer	Macrophyllous vine and shrub	Broadleaf tree over shrub layer	Riparian	Mixed coniferous and broadleaf trees over shrub layer	Buckley Bar	Short's Island	Goose Island	Park Island	Lone Pine Island
Herbs (continued)															
Okanogan stickseed (Hackelia ciliata)	P						2		-	-	-	-			
Whited's halimolobos (Halimolobos whitedii)	P	1							-	-	-	-			
Common sunflower (Helianthus annuus)	A							2	-	-	-	-			
Roundleaf alumroot (Heuchera cylindrica)	P		1		2				-	2	-	-			
Woolly weed (Hieracium scouleri)	P				2-3				1	2-3	-	1			
Jagged chickweed (Holosteum umbellatum	A								-	-	2	-			
Foxtail barley (Hordeum jubatum)	P								-	-	-	-		3	
Western blue flag (Iris missouriensis)	P				1-2			1	-	-	-	-			
Yellow flag (Iris pseudacorus)[c]	P								-	-	-	-			
Tall marsh-elder (Iva xanthifolia)[c]	A							-	-	-	-	-			
Baltic rush (Juncus balticus)	P							2-3[b]	-	-	-	1[b]	2[b]		3[b]
Dagger leaf rush (Juncus ensifolius)	P								2	-	-	-			
Prairie junegrass (Koeleria cristata)	P	2			1-2				-	-	3	-			
Blue lettuce (Lactuca pulchella)[c]	A								-	-	-	-			
Prickly lettuce (Lactuca serriola)	A							1-2	1	-	-	-		1-2	
Duckweed (Lemna minor)	P								2	-	-	-			
Clasping peppergrass (Lepidium perfoliatum)	A			1	2				-	2	-	-			
Prickly phlox (Leptodactylon pungens)	P	3	1						-	-	-	-			
Columbia bladderpod (Lesquerella douglasii	P	2	-		1				-	-	2	-	0		
Bulbiferoua prairiestar (Lithophragma bulbifera)	P		1[b]						-	2	-	-			

See footnotes at end of table.

Spring species list and relative abundance of plants in the Rufus Woods Lake study area.

Plant species	Status P=Perennial A=Annual	Habitat and Plant Abundance[a] Shrub-steppe	Rock	Rockland	Coniferous forest	Coniferous tree over shrub layer	Macrophyllous vine and shrub	Broadleaf tree over shrub layer	Riparian	Mixed coniferous and broadleaf trees over shrub layer	Buckley Bar	Short's Island	Goose Island	Park Island	Lone Pine Island
Herbs (continued)															
Small flowered prairiestar (Lithophragma parviflora)	P	2		-	2			1-2	-	2	-	-	-	-	-
Western gromwell (Lithospermum ruderale)	P	2		2	2			3	-	-	-	-	-	-	-
Fern-leaf lomatium (Lomatium dissectum	P	-	2-3	3					-	2	-	-	-	2	-
Gray's desert-parsley (Lomatium gravi)	P	-		-					-	-	3	-	-	-	-
Nine-leaf lomatium (Lomatium cri ternatum)	P	3		3	2				-		-	-	-	-	-
Cut-leaved water horehound (Lycopus americanus) [c]	P			-					-		-	-	-	-	-
Clover fern (Marsilea vestita) [c]	P			-					-		-	-	-	-	-
Alfalfa (Medicago sativa) [c]	P	-		-					-		-	-	-	-	-
White sweet-clover (Melilotus alba)	P			-			3		-		-	1	2	2	2
Mint (Mentha sp.)	P			-					2		-	-	-	1	-
Field mint (Mentha arvensis)	P	-		-					-	2	-	-	-	-	
Saall bluebells (Mertensia longiflora)	P			-	2				-		-	-	-	-	
Pink microsteris (Microsteris gracilis)	A	1-2		-					-		-	-	-	-	
Yellow monkey-flower (Mimulus guttatus)	P	-		-					3-4		-	-	-	-	-
Line-leaf Indian lettuce (Montia linearis)	A			-	2-3				-		-	-	-	-	-
Miner's lettuce (Montia perfoliata)	A			-	-			3-4	-		-	-	-	-	-
Small flowered forget-me-not (Myosotis laxa)	A			-	2			2	-		-	-	1	-	1
Common evening-primrose (Oenothera strigosa)	P			-					-		-	-	2	-	-
Brittle cactus (Opuntia fragilis)	P	1-2		-	1				-		1	-	-	-	-
Grand Coulee owl-clover (Orthocarpus barbatus)	A	1-2		-					-		-	-	-	-	-

See footnoceo at end of table.

Plant species	Status P=Perennial A=Annual	Shrub-steppe	Rock	Rockland	Coniferous forest	Coniferous tree over shrub layer	Macrophyllous vine and shrub	Broadleaf tree over shrub layer	Riparian	Mixed coniferous and broadleaf trees over shrub layer	Buckley Bar	Short's Island	Goose Island	Park Island	Lone Pine Island
Herbs (continued)															
Indian ricegrass (Oryzopsis hymenoides)	P	2	-			-			-	-	-	-	-	-	-
Yellow beardtonque (Penstemon confertus)	P	-	-		2	-			-	-	-	-	-	-	-
Richardson's penstemon (Penstemon richardsonii	P		-			-	1			-	-	-	-	-	2
Reed canarygrass (Phalaris arundinacea)	P		-			-				-	-	1	-	-	-
Silverleaf phacelia (Phacelia hastata)	P		-			-	2-3			-	1	-	-	-	-
Threadleaf phacelia (Phacelia linearis)	A	2	-			-				-	-	-	-	-	-
Tufted phlox (Phlox caespitosa)	P	-	2			-				-	2	-	-	-	-
Long leaved phlox (Phlox longifolia)	P	3	-	2	2	-				-	-	-	-	-	-
Common plantain (Plantago major)	A	-	-			-			2-3	2	-	-	-	-	-
Indian-wheat (Plantago patagonica)	A	b-S	-	2-3	2-3	-				-	-	-	3	2	4[b]
Bulbous bluegrass (Poa bulbosa)	A	-	-	1-2	1-2	-				-	3	-	-	-	
Canadian bluegrass (Poa compressa)	P		-			-			2-3	-	1-2	-	-	-	-
Nevada bluegrass (Poa nevadensis)	P	-	-		3	-				-	3	-	-	-	-
Wheeler's bluegrass (Poa nervosa var. wheeleri)	P		-		3	-				-	-	-	-	-	-
Kentucky bluegrass (Poa pratensis)	P		-	2	2	-		3	3	3	-	2	4	4	-
Sandberg's bluegrass (Poa sandbergii)	P	2-3	3		-	-				-	-	-	-	-	-
Pine bluegrass (Poa scabrella)	P		1		3	-				-	-	-	-	-	-
Littleleaf polemonium (Polemonium micranthum	A		-		-	-				2	-	-	-	-	-
Smartweed (Polygonum sp.)	A		-		1	-				-	-	-	-	-	-
Common silverweed (Potentilla anserina)[c]	P		-		-	-		-		-	-	-	-	-	-
Tall cinquefoil (Potentilla arguta)	P	1-2[b]	-		2	-		2[b]		-	-	-	-	-	-

See footnotes at end of table.

Spring species *lint* and relative abundance of plants In the Rufua Woods Lake atudv area.

Plant species	Status P-Perennial A-Annual	Habitat and Plant Abundance[a]														
		Shrub-steppe	Rock	Rockland	Coniferous forest	Coniferous tree over shrub layer	Macrophyllous vine and shrub	Broadleaf tree over shrub layer	Riparian	Mixed coniferous and broadleaf trees over shrub layer	Ruckley Bar	Short's Island	Goose Island	Park Island	Lone Pine Island
Herbs (continued)																
Prairie cinquefoil (Potentilla penaylvanica)	P		-			-	-	-	2[b]	-	-	-	-	-	-	
Self-heal (Prunella vulgaris)	A		-			-	-	-	2	-	-	1	-	-	-	
Nuttall's alkaligrass (Puccinellia nuttalliana)	P	-	-		1-2	-	-	-	2	-	-	-	-	-	-	
Shore buttercup (Ranunculus cymbalaria)	A		-			-	-	-	2	-	-	-	-	-	-	
Sagebrush buttercup (Ranunculus glaberrimus)	A		-		2	-	-	-		1-2	-	-	-	-	-	
Poison oak (Rhus radicans)	P		-	1		-	2-3	2		2	-	2	-	2-3	-	
Water-cress(Rorippa nasturtium - aquaticum	P		-			-	-	-	5	-	-	-	-	-	-	
Curly dock (Rumex crisous)	A		-			-	-	-		-	-	2	2	-	-	
Tumbleweed (Salsola kali)[a]	A		-			-	-	-		-	-	-	-	-	-	
Gray ball sage (Salvia dorrii)	P	2	2			-	2	-		-	-	-	-	-	-	
Swamp saxifrage (Saxifraga integrifolia var., leptopetala)	P	2	1[b]		2	-	-	-		-	-	-	-	-	-	
American bulbrush (Scirpus americanus)	P		-	-[1]		-	-	2[b]	3-b	-	-	-	-	-	-	
Small-fruited bulbrush (Scirpus microcarpus)	P	-	-			-	-	-	2	-	-	-	-	-	-	
Narrow-leafed skullcap (Scutellaria angustifolia)	P	-	2			-	2	-		-	2	-	-	-	-	
Lanceleaved atonecrop (Sedum lanceolatum	P	-	-	1		-	-	-		-	-	-	-	-	-	
Wormleaf stonecrop (Sedum stenopetalum)	P	-	-		1-2	-	-	-		-	-	-	-	-	-	
Wallace's selaginella (Selaginella wallacei)	P		-		2	-	-	-		-	-	-	-	-	1-2	
Western groundsel (Senecio integerrimus)	P	-	-		2	-	-	1-2		-	-	-	-	-	-	
Douglas' silene (Silene douglasii)	P	-	-		1-2	-	-	-		-	-	-	-	-	-	
Sticky cockle (Silene noctiflora)	A		-			-	2	2		2	-	-	-	-	-	
Jim Hill mustard (Sisymbrium altissimum)[a]	A	-	-			-	-	-		-	-	-	-	-	-	

See footnotes at end of cable.

Spring species list and relative abundance of plants in the Rufus Woods Lake study area.

Plant species	Status P=Perennial A=Annual	Habitat and Plant Abundance[a] Shrub-steppe	Rock	Rockland	Coniferous forest	Coniferous tree over shrub layer	Macrophyllous vine and shrub	Broadleaf tree over shrub layer	Riparian	Mixed coniferous and broadleaf trees over shrub layer	Buckley Bar	Short's Island	Goose Island	Park Island	Lone Pine Island
Herbs (continued)															
Blue-eyed grass (Sisyrinchium angustifolium)[c]	P		-		-	-	-		-	-		-	-	-	-
Starry Solomon-plume (Smilacina stellata)	P		-		-	-	-	2-3	1	2		-	-	-	-
Bittersweet (Solanum dulcamara)	r		-		-	-	-	2	-	-		1	-	-	0
White stemmed globe-mallow (Sphaeralcea munroana)	P		-		-	-	-	1	-	-		-	-	-	-
Shiny leafed spirea (Spirnea betulifolia)	P		-		2	-	-		-	-		-	-	-	-
Sand dropseed (Sporobolus cryptandrus)	r		-		1-2	-	3		-	-	2-3	-	-	2	0
Hedge-nettle (Stachys sp.)	r		-		-	-	-		1-2	-		-	-	-	-
Narrow-leaf skeletonweed (Stephanomeria tenuifolia	P		-		-	-	3		-	-		-	-	-	0
Needle and thread grass (Stipa comata)	P	3-4	-	2	2-3	-	2		-	-		-	-	-	
Small needlegrass (Stipa occidentalis var. minor)	P	-	-		2	-	-		-	-		-	-	-	-
Slender seablite (Suaeda occidentalis)	A		-		-	-	-		-	-		-	-	-	-
Common dandelion (Taraxacum officinale	P	2	-		-	-	-		-	-		-	-	-	2
Meadowrue (Thalictrum sp.)	P		-		-	-	-	1	2	2-3		-	-	-	-
Goatsbeard (Tragopogon sp.)	A	1	-	1-2	2	-	2		-	-	1	-	-	-	-
Suckling clover (Trifolium dubium)	A		-		-	-	-	2-3	-	-	-	-	-	-	-
White clover (Trifolium repens)	r		-		-	-	-	3	-	-	-	-	-	-	-
Con-on cattail (Typha latifolia)	P	-	-		-	-	-		2	-	-	-	-	-	-
Stinging nettle (Urtica dioica)	P		-		-	-	-	1-2	-	-	-	-	-	-	
Common mullein (Verbascum thapsus)	A		-		3	-	-		1	-	1	-	2	3	2-3
Bracted vervain (Verbena bracteata)[c]	A		-		-	-	-		-	-		-	-	-	

See footnotes at end of table.

Spring species llat and relative abundance **of plants** in the Rufus **Woods** Lake **study** area.

Plant species	Status P-Perennial A-Annual	Aahitat and Plant Abundance[a]														
		Shrub-steppe	Rock	Rockland	Coniferous forest	Coniferous tree over shrub layer	Macrophyllous vine and shrub	Broadleaf tree over shrub layer	Riparian	Mixed coniferous and broadleaf trees over shrub layer	Buckley Bar	Short's Island	Goose Island	Park Island	Lone Pine Island
Herbs (continued)															
American brooklime (Veronica americana)	A							2[b]	2-3						2
Northern bog violet (Viola nephrophylla)	P							2[b]	2						
Nuttall violet (Viola nuttallii var. major)	r		-		2	-	-	-	-						
Woodsia (Woodsia oregana)	P		1[b]	I	2	-	-	-	-						
Rocky Mountain woodsia (Woodsia sco ulina[4])	r		2	-	-	-	2	-	-						
Common cocklebur (Xanthium strumarium)	A														
Death-camus (Zigadenus sp.)	P				2	-	-	-	-						

[a] Relative abundance **scale:** S-abundant, **4=very common, 3=occasional** to **irregularily common, 2=infrequent,** l-rare. **0=single plant seen.**
[b] Not classified to species.
[c] Plant species found during **studies** other than habitat atudlea.

APPENDIX C-2

Birds observed along Rufus Woods Reservoir from 17 July, 1974 through 30 July, 1975 (continued)[a]

Species	Breeding status[b]	Seasonality[c]	Habitats[d]: Shrub-steppe	Rock	Rockland	Coniferous forest	Coniferous tree over shrub layer	Broadleaf tree over shrub layer	Mixed coniferous and broadleaf tree over shrub layer	Macrophyllous vine and shrub	Orchard	Dirt bank	Farmland	Human habitation	Fresh water[e]
Common loon (Gavia immer)		W													U
Arctic loon (Gavia arctica)		M (one record)													r
Red-throated loon (Gavia stellata)		W (four records)													r
Red-necked grebe (Podiceps grisegena)		M (three records)													r
Horned grebe (Podiceps auritus)		W													u
Eared grebe (Podiceps caspicus)		R													C
Western grebe (Aechmophorus occidentalis)		M													U
Pied-billed grebe (Podilymbus podiceps)		W													r
Great blue heron (Ardea herodias)	*	R													R,c
Black-crowned night heron (Nycticorax nycticorax)		S													r
Whistling swan (Olor columbianus)		M (four records)													r
Canada goose (Branta canadensis)	*	R	R			R							c		C,c
White-fronted goose (Anser albifrons)		W (one pair wintered)													r
Snow goose (Chen hyperborea)		M (one bird seen on 3 occasions)													r
Mallard (Anas platyrhynchos)	*	R							R						U,c
Gadwall (Anas strepera)	(?)	R													R,u
Pintail (Anas acuta)		W													U
Green-winged teal (Anas carolinensis)	(?)	R													R,r
Blue-winged teal (Anas discors)	(?)	S													R
Cinnamon teal (Anas cyanoptera)	(?)	S													R
American widgeon (Mareca americana)	(?)	R													R,c
Shoveler (Spatula clypeata)		S													r
Wood duck (Aix sponsa)		S													r
Redhead (Aythya americana)		W													U
Ring-necked duck (Aythya collaris)		W													U
Canvasback (Aythya valisineria)		W													r

Taken from Erickson, et al., 1976 pp. 260-266

[a] See footnotes at end of table

Birds observed along Rufus Woods Reservoir from 17 July, 1974 through 30 July, 1975 (continued)[a]

Species	Breeding status[b]	Seasonality[c]	Habitats[d] Shrub-steppe	Rock	Rockland	Coniferous forest	Coniferous tree over shrub layer	Broadleaf tree over shrub layer	Mixed coniferous and broadleaf tree over shrub layer	Macrophyllous vine and shrub	Orchard	Dirt bank	Farmland	Human habitation	Fresh water
Lesser scaup (Aythya affinis)		W													c
Common goldeneye (Bucephala clangula)		W													c
Barrow's goldeneye (Bucephala islandica)		W													r
Bufflehead (Bucephala albeola)		W													u
Ruddy duck (Oxyura jamaicensis)		W													r
Hooded merganser (Lophodytes cucullatus)		M	(four records)												r
Common merganser (Mergus merganser)	*	R													C,c
Red-breasted merganser (Mergus serrator)		W	(one record)												r
Turkey vulture (Cathartes aura)		S	r	r	r										
Goshawk (Accipiter gentilis)		W	(one record)				r								
Sharp-shinned hawk (Accipiter striatus)		R							r	r	r				r
Cooper's hawk (Accipiter cooperii)		W							r						r
Red-tailed hawk (Buteo jamaicensis)	*	R	c	u	c	r	C		C				u		
Swainson's hawk (Buteo swainsoni)		S	(one record)								r				
Rough-legged hawk (Buteo lagopus)		W	r												
Ferruginous hawk (Buteo regalis)		S	r	(one record)											
Golden eagle (Aquila chrysaetos)	*	R	c	C,c	c	r	U		u		u		u		
Bald eagle (Haliaeetus leucocephalus)		W													c
Marsh hawk (Circus cyaneus)	*	R	u		u								U,u		
Osprey (Pandion haliaetus)		S	(one pair)												u
Prairie falcon (Falco mexicanus)	*	R	r	R,r									r		
Merlin (Falco columbarius)		W	r										r		
American kestrel (Falco sparverius)	*	R	c	C,u	c	u	C,u		C,u		u		c	(dead tr	U
Blue grouse (Dendragapus obscurus)	*	R				C,c									
Ruffed grouse (Bonasa umbellus)	*	R				C,c		C,c	C,c						

[a] See footnotes at end of table

Birds observed along Rufus Woods Reservoir from 17 July, 1974 through 30 July, 1975 (continued)[a]

Species	Breeding status[b]	Seasonality[c]	Habitats[d] Shrub-steppe	Rock	Rockland	Coniferous forest	Coniferous tree over shrub layer	Broadleaf tree over shrub layer	Mixed coniferous and broadleaf tree over shrub layer	Macrophyllous vine and shrub	Orchard	Dirt bank	Farmland	Human habitation	Fresh water
Sharp-tailed grouse (Pedioecetes phasianellus)		W	r (one record)												
Sage grouse (Centrocercus urophasianus)		W	r (one record)												
California quail (Lophortyx californicus)	*	R	U,c		U,c		c	U		u,c	c,c			c	
Ring-necked pheasant (Phasianus colchicus)	*	R	u					C,u	U,u	C,c	C,c				
Chukar partridge (Alectoris graeca)	*	R	u,c	c,c	u			u		U,c					
Gray partridge (Perdix perdix)	(?)	R	R,c					c			c			u	
American coot (Fulica americana)		W	(two summer records)												c[e]
Killdeer (Charadrius vociferus)	*	S													U
Common snipe (Capella gallinago)		W													r
Long-billed curlew (Numenius americanus)	*	S	R										R		
Spotted sandpiper (Actitis macularia)	*	S													C
Solitary sandpiper (Tringa solitaria)		M	(one record)												r
Lesser yellowlegs (Totanus flavipes)		M	(three records)												r
Pectoral sandpiper (Erolia melanotos)		M	(one record)												r
Least sandpiper (Erolia minutilla)		M	(one record)												r
Herring gull (Larus argentatus)		M													u
California gull (Larus californicus)		S													u
Ring-billed gull (Larus delawarensis)		S													c
Bonaparte's gull (Larus philadelphia)		M	(one record)												r
Forster's tern (Sterna forsteri)		M	(one record)												r
Rock dove (Columba livia)	*	R		C								U			u
Mourning dove (Zenaidura macroura	*	R	U	U	C	C,r	C,r	C,r	C,r	R	C,r		r	U,r	
Barn owl (Tyto alba)		R										R,r			
Great horned owl (Bubo virginianus)	*	R		U,u		C,u	C,u	r	C,u						

[a] See footnotes at end of table.

Birds observed along Rufus Woods Reservoir from 17 July, 1974 through 30 July, 1975 (continued)[a]

Species	Breeding status[b]	Seasonality[c]	Habitats[d]: Shrub-steppe	Rock	Rockland	Coniferous forest	Coniferous tree over shrub layer	Broadleaf tree over shrub layer	Mixed coniferous and broadleaf tree over shrub layer	Macrophyllous vine and shrub	Orchard	Dirt bank	Farmland	Human habitation	Fresh water
Burrowing owl (Speotyto cunicularia)	*	S								r			R		
Long-eared owl (Asio otus)	*	R				U,u		R,r	U,u						
Short-eared owl (Asio flammeus)	*	R	u										U,u		
Saw-whet owl (Aegolius acadicus)		W	r (two records)					r							
Poor-will (Phalaenoptilus nuttallii)	*	S	U		U										
Common nighthawk (Chordeiles minor)	*	S	C		C										
Vaux's swift (Chaetura vauxi)		S	r (two records)												
White-throated swift (Aeronautes saxatalis	*	S		C											
Rufous hummingbird (Selasphorus rufus)	*	S				U	U							U	
Calliope hummingbird (Stellula calliope)		S				r		r						r	
Belted kingfisher (Megaceryla alcyon)	*	R										U			u
Common flicker (Colaptes auratus)	*	R	U,u			C,c	C,u	C,u	C,u			U			
Lewis' woodpecker (Asyndesmus lewis)	*	S				C	C		U						r
Downy woodpecker (Dendrocopos pubescens)	*	S				U,u	U,u	u			U,u				c
Eastern kingbird (Tyrannus tyrannus)	*	S	u	c	u		C	U						(dead tre	
Western kingbird (Tyrannus verticalis)	*	S	U	C	C	R	C	U	U	U	C			U	
Say's phoebe (Sayornis saya)	*	S	R		U										
Willow flycatcher (Empidonax traillii)	*	S						R	U	R					
Flycatcher (Hammond's or Dusky) (Empidonax sp.)		S				C									
Western wood pewee (Contopus sordidulus)	*	S					C	U	C						
Horned lark (Eremophila alpestris)	*	R	u										C,c		
Violet-green swallow (Tachycineta thalassina)		M													c
Tree swallow (Iridoprocne bicolor)	*	S													U
Bank swallow (Riparia riparia)	*	S										C			
Rough-winged swallow (Stelgidopteryx ruficollis)	*	S										U			

[a] See footnotes at end of table.

Birds observed along Rufus Woods Reservoir from 17 July, 1974 through 30 July, 1975 (continued)[a]

Species	Breeding status[b]	Seasonality[c]	Habitats[d]: Shrub-steppe	Rock	Rockland	Coniferous forest	Coniferous tree over shrub layer	Broadleaf tree over shrub layer	Mixed coniferous and broadleaf tree over shrub layer	Macrophyllous vine and shrub	Orchard	Dirt bank	Farmland	Human habitation	Fresh water
Barn swallow (Hirundo rustica)	*	S												U	C
Cliff swallow (Petrochelidon pyrrhonota)	*	S				U							cu		c
Steller's jay (Cyanocitta stelleri)		W	(one record)											r	
Black-billed magpie (Pica pica)	*	R	c	U,u		c,c	u,u	U,u	U,u	U,u	R,r				c
Common raven (Corvus corax)	*	R	u	c,c	u										U
Common crow (Corvus brachyrhynchos)	*	R	u			C,c		U,u							
Clark's nutcracker (Nucifraga columbiana)	*	R				C,c									
Black-capped chickadee (Parus atricapillus)	*	R			u	C,c	U,u	C,c	C,c	u	U,u			u	
Red-breasted nuthatch (Sitta canadensis)	*	R				U,u									
Brown creeper (Certhia familiaris)	*	R				U,u									
Dipper (Cinclus mexicanus)	*	R	(one pair located)												R,r
House wren (Troglodytes aedon)	*	S					U	U							
Winter wren (Troglodytes troglodytes)		W	(three records)					r	r						
Canyon wren (Catherpes mexicanus)	*	S		C,u	u	(one winter record)									
Rock wren (Salpinctes obsoletus)	*	S		c	c	R	(three winter records)								
American robin (Turdus migratorius)	*	R		U		C,u	C,u	c,u	C,u		C,u			u	
Varied thrush (Ixoreus naevius)		W						u	u					r	
Western bluebird (Sialia mexicana)		M	r				r	(two records)							
Mountain bluebird (Sialia currucoides)		W	r	(two winter records, uncommon migrant)											
Townsend's solitaire (Myadestes townsendi)		W				u	u	r	u						
Golden-crowned kinglet (Regulus satrapa)	*	R				U,u			u						
Ruby-crowned kinglet (Regulus calendula)	*	R				r		R,r	U,r	u	u				
Water pipit (Anthus spinoletta)		M	(two records)												r

[a] See footnotes at end of table.

Birds observed along Rufus Woods Reservoir from 17 July, 1974 through 30 July, 1975 (continued)[a]

Species	Breeding status[b]	Seasonality[c]	Habitats[d] Shrub-steppe	Rock	Rockland	Coniferous forest	Coniferous tree over shrub layer	Broadleaf tree over shrub layer	Mixed coniferous and broadleaf tree over shrub layer	Macrophyllous vine and shrub	Orchard	Dirt bank	Farmland	Human habitation
Bohemian waxwing (Bomhvcilla garrulus)		W												u
Cedar waxwing (Bombycilla cedrorum)	*	S						r			U			U
Northern shrike (Lanius excubitor)		w	u			U								
Loggerhead shrike (Lanius ludovicianus)	*	s	u	c	u									
Starling (Sturnus vulgaris)	*	R		C,c		C,c	C,c	C,c	C,c			U	c	C,c (dead
Red-eyed vireo (Vireo olivnccus)	*	S						C	C					
Orange-crowned warbler (Vermivora celata)	*	M						U		u				
Yellow warbler (Dendroica petechis)	*	S					R	C	C	R	R			R
Yellow-rumped warbler (Dendroica coronata)		M				U	U	U	U					
Townsend's warbler (Dendroica townsendi)		M	(two records)			r								
MacGillivary's warbler (Oporornis tolmiei)	*	S				R		U	C					
Wilson's warbler (Wilsonia pusilla)	*	S					U	C	C	R	R			
House sparrow (Passer domesticus)	*	R												C,c
Western meadowlark (Sturnella ncrlecta)	*	R	C,c	C,c	U,r	R,r	R,r				R		r	r
Yellow-headed blackbird (Xanthocephalus xanthocephalus)	*	S												
Red-winged blackbird (Agel aius phoeniceus)	*	S												
Northern oriole (Icterus galbula)	*	S		u	u		C	C	C	U	C			u
Brewer's blackbi rd (Euphagus cyanocephalus)	*	R					U							C,c
Brown-headed cowbird (Molothrus ater)	*	S			c	c	U	C	C	U				
Western tanager (Pirange ludoviciana)	*	S				C								
Bl ack-headed grosbeak (Pheuct i cus melanocephalus	*	S						U	U	R				
Lazuli bunting (Passerina amoena)	*	S		c	C-			R		C				
Evening grosbeak (Hesperi phona vespertina)	*	R					U,u		u					
Cassin's finch (Carpodacus cassinii)	*	S					U	U						
House finch (Carpodacus mexicanus)	*	R											C,c	U,u
Pine siskin (Spinus pinus)	*	R					U,u							

[a] See footnotes at end of table.

Birds observed along Rufus Woods Reservoir *from* 17 July, 1974 through 30 July, 1975 (continued)"

	Breeding status[b]	Seasonality[c]	Habitats[d] Shrub-steppe	Rock	Rockland	Coniferous forest	Coniferous tree over shrub layer	Broadleaf tree over shrub layer	Mixed coniferous and broadleaf tree over shrub layer	Macrophyllous vine and shrub	Orchard	Dirt bank	Farmland	Human habitation	Fresh water
American goldfinch (Spinus tristis)	*	R	R,u		R,u			C,u	R,u	C,u					
Red crossbill (Loxia curvirostra)	*	R					U,u	u	u						
Rufous-sided towhee (Pipilo erythrophthalmus)	*	s					C	C	C						
Savannah sparrow (Passcrculus sandwichenris)	*	s	U (grassland areas)												
Grasshopper sparrow (Ammodramus savannarum)		S	(one record)												
Vesper sparrow (Pooecetes gramineus)	*	s	u										u		
Lark sparrow (Chondes tes grammacus)	*	s	c		C					R					
Dark-eyed junco (Junco hyemalis)	*	R	u		u	U,c	u	c	c	u		u			
Tree sparrow (Spizel la arborea)		W	(one record)							r					
Chipping sparrow (Spizella passerina)	*	s				U		U	U						
Brewer's sparrow (Spi zella breweri)	*	s	u												
White-crowned sparrow (Zonotrichia leucophrys)		w	c		UC			u	u	c					u[e]
Fox sparrow (Passerella iliaca)		M	(two records)					r	r						
Song sparrow (Melospiza melodia)	*	R						U,u	u,u	u					u

[b] Breeding: * Known to breed on the study area (either nests located, young birds seen or territorial displays witnessed; ? Suspected of nesting on study area.

[c] Seasonality: R - resident, present all year, although abundance may vary seasonally; S - summer visitor only (includes spring and fall) ; W - winter visitor only (includes fall and spring) ; M - migrant (Spring and/or fall) only.

[d] habitats: See Section 7.3 for detailed description of first 9 habitats: others are self explanatory.

[e] Abundance (in columns under habitats) : C - common; often aeen or heard in appropriate habitats; U - uncommon: usually present but not seen or heard on every visit to appropriate habitats; R - rare; present In appropriate habitats onlv in small numbers and seldom seen or heard. (Capitol letter - breeding habitat; lower case letter - non-breeding habitat).

APPENDIX C-3

Relative abundance and seasonal status of mammal species identified in the Rufus Woods Reservoir study area, July, 1974 - July, 1975.

Species		Relative abundance[a]	Seasonality[b]
Yellow-bellied marmot	(Marmota flaviventrli)	Common	Resident
Lsast chipmunk	(Eutamias minimus)	Rare	Resident
Yellow pine chipmunk	(Eutamias amoenus)	Rare	Resident
Northern pocket gopher	(Thomomys talpoides)	Common	Resident
Great Basin pocket mouse	(Perognathus parvus)	Abundant	Resident
Western harvest mouse	(Reithrodontomys megalotis)	Rare	Resident
Bushy-tailed wood rat	(Neotoma cinerea)	Common	Resident
Deer Mouse	(Peromyscus maniculatus)	Abundant	Resident
Sagebrush meadow mouse	(Lagurus curtatus)	Common	Rssident
Muskrat	(Ondatrazibethica)	Rare	Resident
House mouse	(Mus musculus)	Rare	Resident
Montane meadow mouse	(Microtus montanus)	Common	Resident
Beaver	(Castor canadersis)	Rare	Resident
Porcupine	(Erethizon dorsatum)	Common	Resident
White-tailed hare	(Lepus townsendii)	Rare	Resident
Nuttall cottontail	(Sylvilagus nuttallii)	Common	Resident
shrew	(Sores sp.)	Rare	Resident
Coyote	(Canis latrans)	Abundant	Resident
Black bear	(Ursus americanus)	Rare	Visitor
Raccoon	(Procyon lotor)	Common	Resident
Wolverine	(Gulos c u s)	Rare	Visitor
Badger	(Taxidea taxus)	Rare	Resident
Striped skunk	(Mephitis i t i s)	Rare	Resident
Bobcat	(Lynx rufus)	Common	Resident
Mule deer	(Gdocoileus hemionus)	Abundant	Resident & local migrant
White-tailed deer	(Wocoileus virginianus)	Rare	Local migrant
Noose	(Alces alces)	Rare	Visitor
Bat	(sp.)is	Common	Resident

a Abundance rating: Abundant = frequently recorded; Common = regularily recorded in low abundance: Rare = infrequent records.

b Seasonality: Resident = year-lonq presence in studv area: Local Migrant = seasonal in-migrant: Visitor = occasional occurrence.

❄☺&♏■ from Erickson, et al., 1976 pp. 174

APPENDIX C-4
Partial List of Reptiles and Amphibians Found in Project Area

Reptiles

Painted turtle	Chrysemys picta
Sagebrush lizard	Sceloporus graciosus
W. fence lizard	Sceloporus occcidentalis
Side-blotched lizard	Uta stansburiana
Western skink	Eumeces skiltonianus
Rubber boa	Charina bottae
Yellow-bellied racer	Coluber constrictor
Gopher snake	Pituophis melanoleucus
W. garter snake	Thamnophis elegans
Western rattlesnake	Crotalus virdis

Amphibians

Long-toed salamander	Ambystoma macrodactylum
Tiger salamander	Ambystoma tigrinum
Great basin spadefoot	Scaphiopus intermontanus
Pacific treefrog	Hyla regilla

Taken from Foster, et al., 1982
pp. 788-791

APPENDIX C-5

WASHINGTON DEPARTMENT OF WILDLIFE
List of State and Federally recognized Species of Special Concern

The following code explanations pertain to the following species list:

STATE STATUS

CODE EXPLANATION

SE **STATE ENDANGERED** - Wildlife species native to the state of Washington that are seriously threatened with extinction throughout all or a significant proportion of their ranges within the state. Endangered species are legally designated in WAC 232-12-014.

ST STATE **THREATENED** - Wildlife species native to the state of Washington that are likely to become endangered within the foreseeable future throughout significant portions of their ranges within the state without cooperative management or the removal of threats. Threatened species are legally designated in WAC 232-12-011.

ss STATE **SENSITIVE** - Wildlife species native to the state of Washington that are vulnerable or declining and are likely to become endangered or threatened in a significant portion of their ranges within the state without cooperative management or the removal of threats. Sensitive species are legally deaignated in WAC 232-12-011.

SC **STATE CANDIDATE** - Wildlife species that are under revier by the Department for possible listing as endangered, threatened, or sensitive. A species will be considered for State Candidate designation if sufficient scientific evidence suggests that its status may meet criteria defined for endangered, threatened, or sensitive in WAC 232-12-297. Currently listed State Threatened or State Sensitive Species may also be designated as a State Candidate Species if their status is in question. State Candidate Species will be managed by the Department, as needed, to ensure the long- term survival of populations in Washington. They are listed in WDW Policy 4802.

SM **STATE MONITOR** - Wildlife species native to the State of Washington that:

1) were at one time classified as endangered, threatened, or sensitive;

2) require habitat that has limited availability during some portion of its life cycle;

3) are indicators of environmental quality;

4) require further field investigations to determine population status:

5) have unresolved taxonomy which may bear upon their status classification:

6) may be competing with and impacting other species of concern; or

7) have significant popular appeal.

State monitor species will be managed by the department, as needed, to prevent them from becoming endangered, threatened, or sensitive.

Species already classified in a category that provides adequate management emphasis, survey work, and data maintenance (e.g., game animals, game birds, furbearers, etc.) will not be designated as State Monitor Species. Monitor species are designated in Wildlife Policy 4803.

FEDERAL STATUS

CODE	EXPLANATION
FE	FEDERAL ENDANGERED - A species in danger of extinction throughout all or a significant portion of its range.
FT	FEDERAL THREATENED - A species which is likely to become endangered within the foreseeable future.
FP	FEDERAL PROPOSED - A species that is the subject of a proposed or final rule indicating the appropriateness of listing as threatened or endangered.
FC1	FEDERAL CANDIDATE CATEGORY 1 - A species that is a candidate for listing under the Endangered Species Act. U.S. Fish and Wildlife Service has substantial evidence to support listing as threatened and endangered species.
FC2	FEDERAL CANDIDATE CATEGORY 2 - A species that is a candidate for listing under the Endangered Species Act. Listing is possibly appropriate but conclusive information is lacking.
FC3	FEDERAL CANDIDATE CATEGORY 3 - A species that was once considered for listing under the Endangered Species Act which is no longer being considered.

Washington Department of Wildlife
Species of Special Concern
Jan. 22, 1992

Common name/Scientific name	State Status	Federal Status
Invertebrates		
Newcomb's littorine snail Algamorda newcombiana	SM	FC2
Giant Columbia River limpet Pisherola nuttalli	SC	FC2
Great Columbia River spire snail Fluminicola columbiana	SC	FC2
Beller's ground beetle Agonum belleri	SC	FC2
Long-homed leaf beetle Donacia idola	SC	FC3
Columbia River tiger beetle Cicindela columbica	SC	FC3
Hatch's click beetle Eanus hatchii	SC	FC2
Fender's soliperlan stonefly Soliperla fenderi		FC2
Silver-spotted skipper Epsrgyreus clarus californicus	St4	
Northern cloudy wing Thorybes pylades	SM	
Dreamy duskywing Erynnis icelus	SM	
Propertius' duskywing Erynnis propertius	SM	
Pacuvius' duskywing Erynnis pacuvius lilius	St4	
Afranius' duskywing Erynnis afranius	SM	
Persius' duskywing Erynnis persius	SM	
Alpine checkered skipper Pyrgus centaureae loki	SW	
Arctic skipper Csrterocephalus palaemon mandan	SM	
Garita skipperling Oarisma garita	SM	
Juba skipper Hesperia juba	St4	
Oregon branded skipper Hesperia comma oregonia	SM	
Nevada skipper Heaperia nevada	SM	
Yellowpatch skipper Polites coras	SM	
Mardon skipper Polites mardon	SC	

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Common name/Scientific name	State Status	Federal Status
Invertebrates (continued)		
Tawny-edged skipper Polites themistocles	SM	
Long-dash skipper **Polites** mystic sap.	SM	
Sonora skipper Polite8 **sonora sonora**	SM	
Sonora skipper Polites **sonora siris**	SM	
Coastal woodland skipper Ochlodes sylvanoides orecoasta	SM	
Bonneville skipper Ochlodes sylvanoides bonnevilla	SM	
Yuma skipper Ochlodes yuma	SC	
Dun skipper Euphyes vestris vestris	SM	
Kiowa skipper **Euphyes** vestris kiowa	SM	
Roadside skipper **Amblyscirtes vialis**	SM	
Shepard's **parnassian** Psmassius clodius **shepardi**	SC	
Eastern tiger swallowtail Pspilio (Pterourus) **glaucus** canadensis	SM	
Checkered white **Pieris (Pontia)** protodice	SM	
Western sulphur Colias occidentalis occidentalis	SM	
Labrador sulphur Colias nastes streckeri	SM	
Lustrous copper Lycsena **cuprea** henryae	SM	
Edith's copper Lycsena **editha editha**	SM	
Ruddy copper Lycsena **rubida** perkinsorum	SM	
Purplish copper Lycsena helloides	SM	
Makah copper (Queen Charlotte copper) Lycaena mariposa charlottensis	SC	
Golden hairstreak Habrodais **grunus herri**	SC	
Coral hairstreak Harkenclenus titus **immaculosus**	SM	
Sylvan hairstreak Satyrium sylvinum sylvinum	SM	

Washington Department of Wildlife
Species of Special Concern
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Common name/Scientific name	State Status	Federal Status
Invertebrates (continued)		
Sylvan hairstreak *Satyrium sylvinum putnami*	SM	
Bramble green hairstreak *Callophrys dumetorum dumetorum*	SM	
Oregon green hairstreak *Callophrys dumetorum oregonensis*	SH	
Immaculate green hairstreak *Callophrys affinis affinis*	SM	
Canyon green hairstreak *Callophrys sheridanii neoperplexa*	SM	
Thicket hairstreak *Mitoura spinetorum spinetorum*	SM	
Johnson's (mistletoe) hairstreak *Mitoura johnsoni*	SC	
Arborvitae hairstreak *Mitoura rosneri rosneri*	SM	
Basin hairstreak *Mitoura barryi*	SC	
Juniper hairstreak *Mitoura siva* sap.	SC	
Moss elfin *Incisalia mossii mossii*	SM	
Hoary elfin *Incisalia polia obscura*	SM	
Shelton pine elfin *Incisalia eryphon sheltonensis*	SM	
Eastern tailed blue *Everes comyntas comyntas*	SM	
Branded azures *Celastrina argiolus echo*	SM	
Puget blue *Plebejus icarioides erymus*	SC	
High mountain blue *Agriades glandon megalo*	SM	
Puget sound silverspot *Speyeria cybele pugetensis*	SM	
Oregon silverspot *Speyeria zerene hippolyta*	ST, SC	FT
Valley silverspot *Speyeria serene bremnerii*	SC	
Egleis fritillary *Speyeria egleis oweni*	SM	
Egleis fritillary *Speyeria egleis mcdunnoughi*	SM	
Hydaspe fritillary *Speyeria hydaspe rhodope*	SM	

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Species of Special Concern
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Common name/Scientific name	State Status	Federal Status
Invertebrates (continued)		
Silver-bordered bog fritillary Boloria selene atrocostalis	SC	
Meadow fritillary Boloria bellona asp.	SM	
Freya's fritillary Boloria freija freija	SM	
Astarte fritillary Boloria astarte	SM	
Northern checkerspot Chlosyne **palla palla**	SM	
Pasco pearl crescent Phyciodes **"tharos"** pascoensis	SM	
Pale crescent Phyciodes **pallidus barnesi**	SM	
Perdiccas checkerspot Euphydryas chalcedona perdiccas	SM	
Snowberry checkerspot Euphydryas chalcedona wallacensis	SM	
Whulge checkerspot Euphydryas **editha taylori**	SC	
Oreas anglewing Polygonia **oreas**	SM	
Compton tortoiseshell **Nymphalis** vau-album **watsoni**	SM	
American painted lady Vanessa virginiensis	St4	
Viceroy **Limenitis** archippus lahontani	SM	
California sister Adelpha bredowii **californica**	SM	
Island ochre ringlet Coenonympha **"tullia"** insulana	sn	
Great **grayling** Oeneis nevadensis **gigas**	SC	
Chryxus arctic Oeneis **chryxus** chryxus	SM	
Valerata arctic Oeneis chryxus valerata	St4	FC3
Melissa arctic Oeneis melissa beanii	SM	
Fish		
Pygmy whitefish Prosopium coulteri	SM	

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Species of Special Concern
Jan. 22, 1992

Common name/Scientific name	State Status	Federal Status
Fish (continued)		
Redband trout **Salmo** sp.		FC2
Bull trout Salvelinus confluentis		FC2
Olympic mudminnow Novumbra hubbsi	SC	FC2
Lake chub Couesius plumbeus	SM	
Nooky **dace** **Rhinichthys** cataractae ssp.	SM	
Salish sucker Catostomus sp.	SM	
Mountain sucker Catostomus platyrhynchus	SM	
Sand roller Percopsis transmontana	SM	
Piute sculpin Cottus beldingi	SM	
Slimy sculpin Cottus **cognatus**	SM	
Riffle sculpin Cottus gulosus	SM	
Margined sculpin Cottus marginatus	SM	
Reticulate sculpin Cottus perplexus	sn	
Amphibians		
Tiger salamander **Ambystoma** tigrinum	SM	
Cope's giant salamander Dicsmptodon **copei**	SM	
Olympic **salamander** Rhyacotriton olympicus	sn	
Dunn's salamander **Plethodon dunni**	SC	
Larch mountain salamander Plethodon larselli	SC	FC2
Van **dyke's** salamander Plethodon vandykei	SC	
Woodhouse's toad Bufo woodhousei	SM	
Tailed frog Ascaphus **truei**	SM	

Washington Department of Wildlife
Species of Special Concern
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Common name/Scientific name	State Status	Federal Status
Amphibians (continued)		
Red-legged frog **Rana** aurora		FC2
Cascades frog **Rana cascadae**		FC2
Spotted frog **Rana** pretiosa	SC	FC2
Reptiles		
Western pond turtle **Clemmys** marmorata	ST, SC	FC2
Olive Ridley sea turtle Lepidochelys olivacea	SC	FT
Leatherback sea turtle Dermochelys coriacea	SE	FE
Green sea turtle Chelonia mydas	ST	FT
Loggerhead sea turtle Caretta caretta	ST	FT
Southern alligator lizard Elgaria multicarinata	SM	
Sharp-tailed snake Contia tenuis	SM	
Ring-necked snake Diadophis punctatus	SM	
Night snake Hypsiglena torquata	SM	
California mountain kingsnake **Lampropeltis zonata**	SC	
Striped whipsnake **Masticophis** taeniatus	SC	
Pacific gopher snake Pituophis melanoleucus catenifer	SM	
Birds		
Common loon Gavia immer	SC	
Homed grebe Podiceps auritus	SM	
Red-necked grebe Podiceps grisegena	SM	
Western grebe **Aechmophorus** occidentalis	SM	
Clark's grebe **Aechmophorus** clarkii	SM	

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Common name/Scientific name	State Status	Federal Status
Birds (continued)		
American white pelican Pelecanus erythrorhynchos	SE	
Brown pelican Pelecanus occidentalis	SE	FE
Brandt's cormorant Phalacrocorax penicillatus	SC	
Great blue heron Ardea herodias	sn	
Great egret Casmsrodius albus	SM	
Green-backed heron Butorides striatus	SM	
Black-crowned night-heron Nycticorax nycticorax	SM	
Aleutian Canada goose Branta canadensis leucopareia	SE	FE
Harlequin duck Histrionicus histrionicus		FC2
Turkey vulture Cathartes aura	SM	
Osprey Pandion haliaetus	SM	
Bald eagle Haliaectus leucocephalus	ST	FT
Northern goshawk Accipiter gentilis	SC	FC2
Swainson's hawk Buteo swainsoni	SC	
Ferruginous hawk Buteo regalia	ST	FC2
Golden eagle Aquila chrysaetos	SC	
Merlin Falco columbarius	SM	
Peregrine falcon Falco peregrinus	SE	FE
Gyrfalcon Falco rusticolus	SM	
Prairie falcon Falco mexicanus	sn	
Sage grouse Centrocercus urophasianus	SC	FC2
Sharp-tailed grouse Tympanuchus phasianellus	SC	FC2
Mountain quail Oreortyx pictus		FC2

Washington Department of Wildlife
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Common name/Scientific name	State Status	Federal Status
	Birds (continued)	
Sandhill crane Grus canadensis	SE	
Snowy plover Charadrius alexandrinus	SE	FC2
Black-necked stilt Himantopus mexicanus	SM	
Upland sandpiper Bartramia longicauda	SE	
Long-billed curlew Numenius americanus	SM	FC2
Caspian tern Sterna caspia	SM	
Arctic tern Sterna paradisaea	SM	
Forster's tern Sterna forsteri	St4	
Black tern Chlidonias niger	SM	FC2
Marbled murrelet Brachyramphus marmoratus	SC	FP
Yellow-billed cuckoo Coccyzus americanus	SC	
Flammulated owl otus flammeolus	SC	
Snowy owl Nyctea scandiaca	SM	
Burrowing owl Athene cunicularia	SC	
Spotted owl Strix occidentalis	SE	FT
Barred owl Strix varia	SM	
Great gray owl Strix nebulosa	SM	
Boreal owl Aegolius funereus	SM	
Black swift Cypseloides niger	sn	
Vaux's swift Chaetura vauxi	SC	
Lewis' woodpecker Melanerpes lewis	SC	
White-headed woodpecker Picoides albolarvatus	SC	
Three-toed woodpecker Picoides tridactylus	SM	

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Common name/Scientific name	State Status	Federal Status
Birds (continued)		
Black-backed woodpecker Picoidea **arcticus**	sn	
Pileated woodpecker Dryocopus pileatus	SC	
Gray flycatcher **Empidonax** wrightii	**SM**	
Ash-throated flycatcher **Myiarchus** cinerascens	**SM**	
Streaked homed lark Eremophila alpestris strigata	SH	
Purple martin **Progne subis**	SC	
Boreal chickadee **Parus** hudsonicus	**SM**	
Western bluebird Sialia **mexicana**	SC	
Sage thrasher Oreoscoptes montanus	SC	
Loggerhead shrike **Lanius** ludovicianus	SC	**FC2**
Green-tailed towhee **Pipilo chlorurus**	SC	
Oregon vesper sparrow Pooecetes gramineus affinis	SH	
Sage sparrow **Amphispiza belli**	SC	
Grasshopper sparrow **Ammodramus** savannarum	**SM**	
Lesser goldfinch Carduelis psaltria	**sn**	
Mammals		
Prebles shrew **Sorex** preblei	St4	**FC2**
Pacific water shrew **Sorex** bendirii	**SM**	
Destruction Island shrew **Sorex** trowbridgii destructioni		FC2
Merriam's shrew **Sorex merriami**	**SC**	
Pygmy shrew **Sorex** hoyi	**SC**	
Keen's **myotis** **Myotis** keenii	**sn**	

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Common name/Scientific name	State Status	Federal Status
Mammals (continued)		
Long-eared **myotis** **Myotis** evotis	SM	
Fringed **myotis** **Myotis** thysanodes	SM	
Long-legged **myotis** **Myotis** volans	SM	
Small-footed **myotis** **Myotis** leibii	SW	
Western **pipistrelle** Pipistrellus hesperus	sn	
Red bat Lasiurus borealis	SM	
Townsend's big-eared bat Plecotus **townsendii**	SC	FC2
Pallid bat Antrozous **pallidus**	sn	
Pygmy rabbit Brachylagus idahoensis	ST, SC	**FC2**
Red-tailed chipmunk **Tamias ruficaudus**	SM	
Washington **ground** squirrel Spermophilus washingtoni	sn	
Western gray squirrel **Sciurus** griseus	SC	
Brush prairie pocket gopher Thomomys talpoides **douglasi**	SC	
White salmon pocket gopher Thomomys talpoides **limosus**	St4	
Tacoma pocket gopher **Thomomys** mazama **tacomensis**		**FC2**
Shelton pocket gopher Thomomys **mazama couchi**	SC	
Roy prairie pocket gopher **Thomomys mazama** glacialis	SC	**FC2**
Cathlamet pocket gopher **Thomomys** mazama louiei	SC	**FC2**
Olympic pocket gopher **Thomomys** mazama **melanops**	sn	
Tenino pocket gopher Thomomys mazama tumuli	SC	
Ord's kangaroo rat **Dipodomys** ordii	SM	
Northern grasshopper mouse **Onychomys** leucogaster	SM	
Kincaid's meadow vole **Microtus** pennsylvanicus kindaidi	SM	**FC2**

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Species of Special Concern
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Common name/Scientific name	State Status	Federal Status
Mammals (continued)		
Gray-tailed vole **Microtus** canicaudus	**SM**	
Shaw Island vole Microtus townsendii pugeti		FC2
Sagebrush **vole** Lagurus curtatus	**SM**	
Northern bog **lemming** **Synaptomys** borealis	sn	
Gray wolf **Canis** lupus	SE	FE
Grizzly bear **Ursus** arctos	SE	**FT**
Northern sea lion **Eumetopias** jubatus	SC	**FT**
California sea lion **Zalophus** californianus	**SM**	
Fisher **Martes** pennant i	SC	**FC2**
Wolverine Gulo gulo	**SM**	FC2
Sea otter **Enhydra** lutris	SE	
Harbor seal Phoca **vitulina**	**SM**	
Lynx Lynx **canadens** is	SC	FC2
Gray whale Eschrichtius **robustus**	SE	FE
Sei whale Balaenoptera borealis	SE	FE
Fin whale Baleonoptera physalus	SE	FE
Blue whale Balaenoptera musculus	SE	FE
Hump-backed whale **Megaptera** novaeangliae	SE	FE
Black right whale Balaena glacialis	SE	FE
Killer whale Orcinus orca	**SM**	
Pacific harbor porpoise Phocoena phocoena	SC	
Doll's porpoise Phocoenoides **dalli**	**SM**	
Sperm whale Physeter macrocephalus	SE	FE

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Species of Special Concern
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Common name/Scientific name	State Status	Federal Status
Mammals (continued)		
Columbian white-tailed deer *Odocoileus virginianus leucurus*	SE	FE
Mountain caribou *Rangifer tarandus*	SE	FE
California bighorn sheep *Ovis canadensis californiana*		FC2

APPENDIX D
Unpublished Habitat Evaluation Procedure (HEP) Models

The following materials are unpublished habitat evaluation models used to determine the habitat suitability indices for the Chief Joseph Dam Wildlife Mitigation study.

1. Spotted Sandpiper (Actitis macularia)
2. Canada Goose (Branta canadensis)
3. Mule Deer (Odocoileus hemionus)
4. Sage Grouse (Centrocercus urophasianus)
5. Sharp-tailed Grouse (Tympanuchus phasianellus)
6. Ring-necked Pheasant (Phasianus colchicus)
7. Bobcat (Felis rufus)

Spotted Sandpiper - Willamette Ecoregion

Geoffrey L. Dorsey

Bent (1929) stated that the spotted sandpiper (Actitis macularia) was a widely distributed species. occurring on the margins of sandy ponds, sea shores, and rocks bordering streams.

Bays (1973) reported that spotted sandpiper nests were located in grassy upland areas of an island. Oring and Knudson (1973) stated that spotted sandpipers used all the sparsely vegetated areas on *an* island as *nest* sites. Bent (1929) stated that nest sites were variable; high areas of sand island in high. rank sedge grass. on grassy, overgrown gravel bars. in driftwood piles, under extending tree branches, under rock ledges, and under decayed logs representing reported nest sites. Nest sites are close to water (Bent 1929). Oring and Knudson stated that spotted sandpipers nest in sparsely vegetated areas. Bent (1929) stated that spotted sandpipers will not nest in densely wooded areas. Oring and Knudson (1973) reported 3/98 nests beneath dense shrubs or trees. Oring and Knudson (1973) attributed nest placement in a wooded area on an island to disturbance by fisherman and intensive aggressive encounters of sandpipers for nesting territories. Wooded areas represent marginal nesting habitat (Oring and Knudson 1973). Oring and Knudson (1973) reported no spotted sandpipers nesting in densely wooded areas surrounding a lagoon. Bent (1929) reported that spotted sandpipers nest just above the highwater mark *on* tree-lined shores. Stout (1967) stated that nests are often remote from water.

Oring and Knudson (1973) reported that initial nest site selection occurred when scattered herbaceous and grassy cover was less than 10 cm in height (sandy area). Oring and Knudson (1973) observed four nests in herbaceous cover 0.5 m in height and 30 • or less from the beach. Three nests were located in mixed deciduous woods 8-13 • higb and 20-50 • from the beach. Miller and Miller (1948) stated that all nests were situated to be well shaded at all times. Miller and Miller (1948) reported that nests were at least 12.19 m apart. Miller and Miller (1948) observed 35/39 nests in thickly growing grass 15.24 - 76.2 cm in height.

Hays (1973) stated that spotted sandpipers bave a nesting site fidelity; 66 percent of marked birds returning to the previous years nesting area.

Stout (1967) reported that spotted sandpipers were territorial In winter.

Killer and Killer (1948) reported a colonial breeding situation. 38 pairs/S.46 ha. Kuenzel and Yiegert (1973) reported a territorial size of approximately 1.21 ha per bird. Heideaan and Oring (1976) stated that 4-S pairs/6.8 ha was a greater concentration than typically encountered. Heideman and Oring (1976) reported 10 active nests/1.6 ha in a dense deciduous woods to sparsely vegetated beach habitat.

Spotted sandpipers feed primarily on Insects. especially aquatic insects.

SANDPIPE.PW.LR.lg.09/24/87

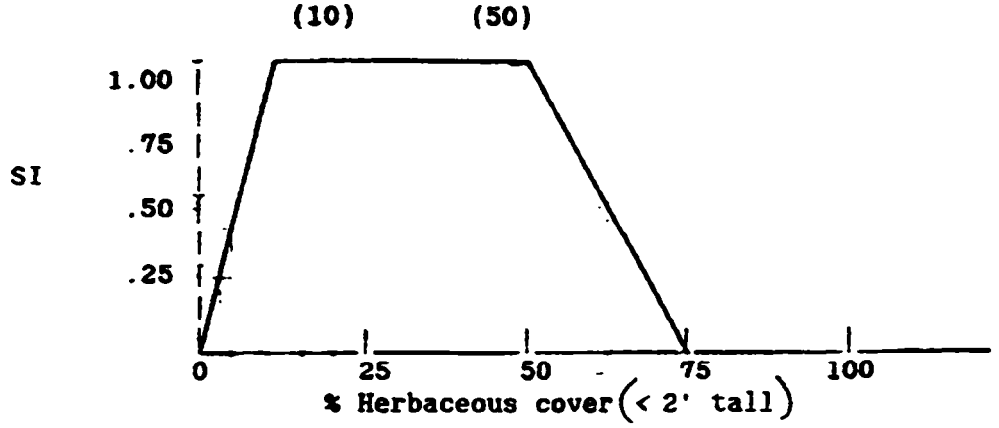
SPOTTED SANDPIPER SUITABILITY INDEX

***Nesting Cover* (V1)**

A mosaic of **herbaceous** ground cover with an overall density of less than 50% and less than 2' high (an overotory of deciduous trees can be present if the ground cover requirements are **met).**

Flooding probably not a **significant** problem as the sandpiper is quite capable **of renesting** if necessary.

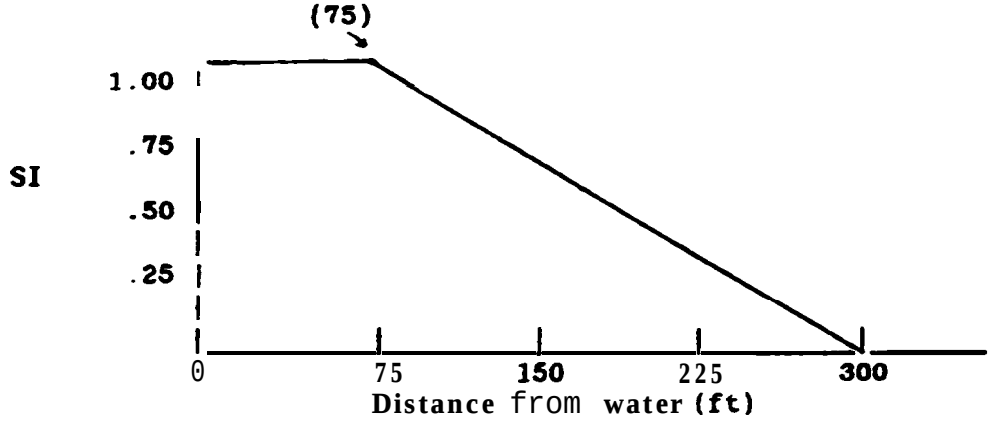
[150 ft. transect, 25 ft. intervals. **Begin transect** where V3 crosses daily high **water** mark and continue inland 150 ft.] (go at angle if necessary to stay in cover type)



***Nesting distance from water* (V2)**

Optimum Nesting habitat is **within 75** ft. of water.

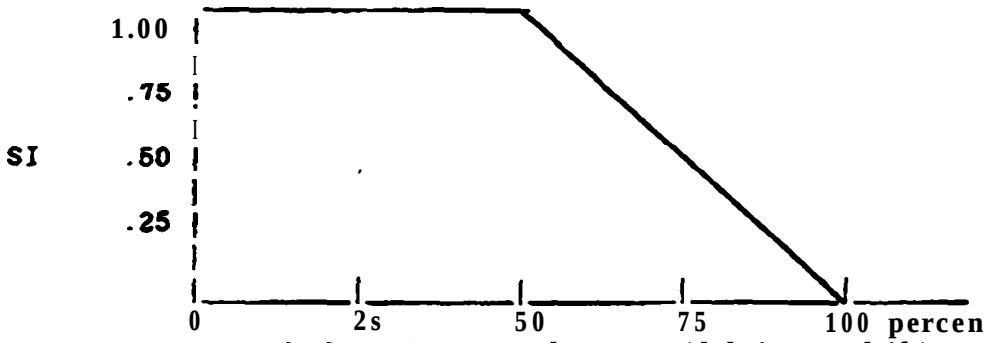
[measure **minimum** distance between **nesting** habitat and **water]**



Foraging habitat (V3) -

Open or sparsely vegetated shorelines (gravel, riprap, or sandy substrates) within 150 feet (45 m) of water (normal pool) which may contain some organic debris or drift.

[Begin transect at EOW and go inland 150 ft. with measurements every 25 ft.]
(If cover type ends before 150 feet, angle transect to obtain 150 ft cover type)
(50)



Model Equation

$$HSI = \frac{V1 + V2 + V3}{3}$$

Literature Cited

Bent, A.C. 1929. Life histories of North American shore birds. U.S. Natl. Mus. No. 146.

Hays, H. 1973. Polyandry in the spotted sandpiper. Living Bird 12:43-58.

Heideman, M.K., and L.W. Oring. 1976. Functional analysis of spotted sandpiper (Actitis macularia) song. Behavoir 56(3-4):181-193.

Kuenzel. W.J., and R.G. Wiegert. 1973. Energetics of a spotted sandpiper feeding on brine fly larvae (Paracoenia: Diptera: Ephydridae) in a thermal spring couunlty. Wilson Bull. 85(4):473-476.

Killer, J.R.. and J.T. Miller. 1948. Nesting of the spotted sandpiper at Detroit, Michigan. Auk 65(4):558-567.

Oring. L.W., and M.L. Knudson. 1973. Monogamy and polyandry in the spotted sandpiper. Living Bird 11:59-74.

Stout, G.D. 1967. The Shorebirds of North America. Viking Press, New York.

Canada Goose Model for Chief Joseph Dam Study

This model was modified from models developed during the Albeni Falls wildlife impact assesment (Martin et al. 1988) and for the Palisades Project (Sather-Blair and Preston 1985). This Chief Joseph model was developed to describe the quality of goose breeding habitat around Rufus Hoods Lake. It considered only nesting and brood-rearing areas which are the most important components determining the quality of Canada goose breeding habitat.

Resting

Islands

Stable islands present; Ground cover on portions of islands 4 inches to 16 inches high; Brood habitat is within 1 mile of area.	0.8 - 1.0
Stable islands present; Cover on islands less than 4 inches or greater than 16 inches; or Brood habitat is 1 to 3 miles . fromarea.	8.5 - 0.7
No stable islands present; or Is lands with limited or no cover; or Brood habitat greater than 3 miles away.	0.0 - 0.4

Brood-rearing

Brood pasture easily accessible from main water body; Foraging zones comnon; Vegetation less than or equal to 4 inches tall (palletable,succulant herbaceous), Greater than l/i! acre in size; Open water wetlands are present (lack of predator cover).	0.7 - 1.0
Less than above and/or no open water wetlands; or area is 1 to 2 miles from nesting habitat; Vegetation is greater than or equal to 4 inches and less than 8 inches tall; Size is greater than 0.1 acre but less than 0.5 acre.	0.4 - 0.6

Little or no brooding area; or Area is less than 0.1 acre and is 0.0 - 0.3 greater than 2 miles from nesting habitat; Vegetation is greater than 8 inches tall.

MODEL

$$HSI = \frac{\text{Nesting Suitability Index} + \text{Brood-rearing Suitability Index}}{2}$$

MULE DEER

CHARACTERISTICS

Mule deer are best distinguished by the small black tipped tail, evenly forked antlers, and large (4 inch) scent gland inside the back leg.

FOOD AND HABITAT REQUIREMENTS

The availability of adequate browse is often the limiting factor for mule deer populations over much of their range (Schneegas and Bumstead 1977). Browse often furnishes 75% or more of the mule deer's winter diet. Forbs and grasses are supplemental winter foods and their availability will result in an increased food value for mule deer. Quantity and quality of nutritious forage in the spring has a major effect on mule deer production and survival (Wallmo et al. 1977).

Thermal cover is provided by woody vegetation over 5 feet tall with a crown cover exceeding 50%. Hiding cover is defined as vegetation greater than 24 inches tall that can hide 90% of a bedded deer at 150 feet or less (Hall 1985). Topographic relief also provides hiding cover value as well as thermal protection from winds (Zender, Ashley, pers comm 1990).

STATUS IN WASHINGTON

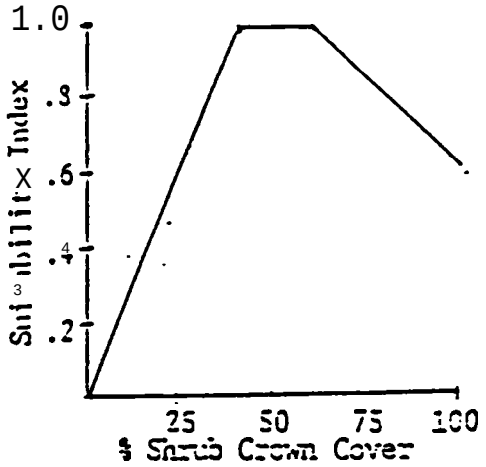
Overall deer populations in southeast Washington are not low now. However, if an extended series of droughts or severe winters significantly reduced current numbers, many herds could not rebuild very easily with the existing low buck/doe ratios. A ratio of about 15 bucks for every 100 does is needed for adequate reproduction. However, most southeast Washington mule deer herds have declined to less than 5 bucks per 100 does.

Winter Habitat

Variable 1: Percent Shrub Crown Cover ≤ 5 ft in height (do not consider small conifers as shrubs)

V1 Field values.

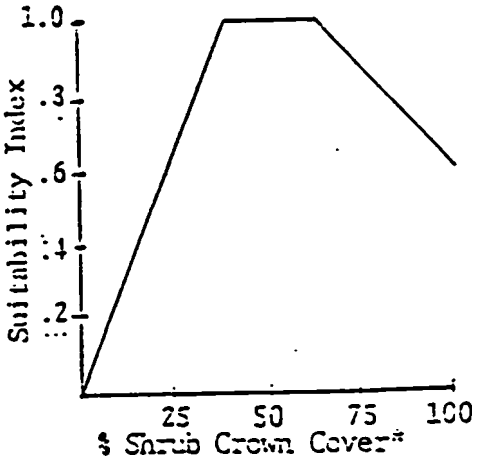
		0% =	0
		< 25% =	.2
25	-	40% =	.7
41	-	60% =	1.0
61	-	100% =	.3



Variable 2: Percent Shrub Crown Cover of preferred shrubs ≤ 5 ft in height*

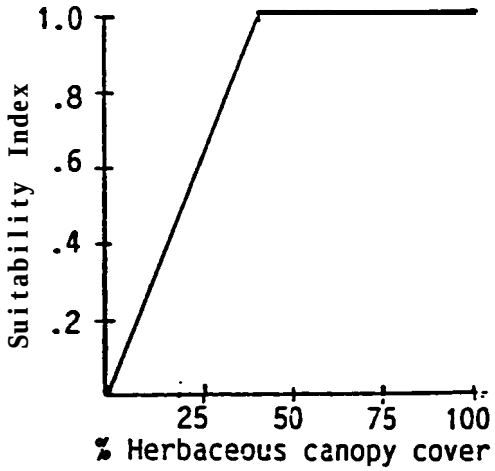
V2 Field values:

		0% =	0
		< 25% =	.2
25	-	40% =	.7
41	-	60% =	1.0
61	-	100% =	.3



* Preferred shrubs include, but are not limited to: bitterbrush, serviceberry, nine bark, chokecherry, rose spp., squaw current, willow, water birch, aspen.

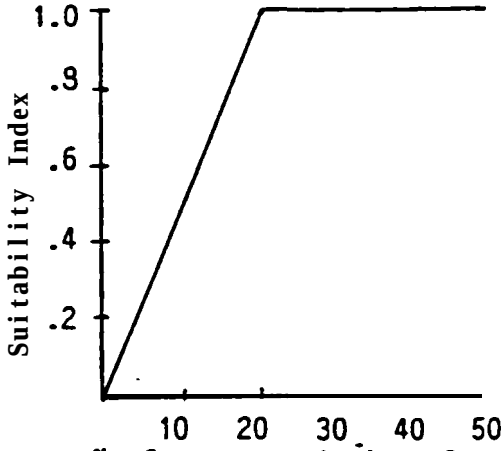
Variable 3: Percent herbaceous canopy cover.



V3 Field values:

0%	0
<25%	.2
25 - 40%	.7
>40%	1.0

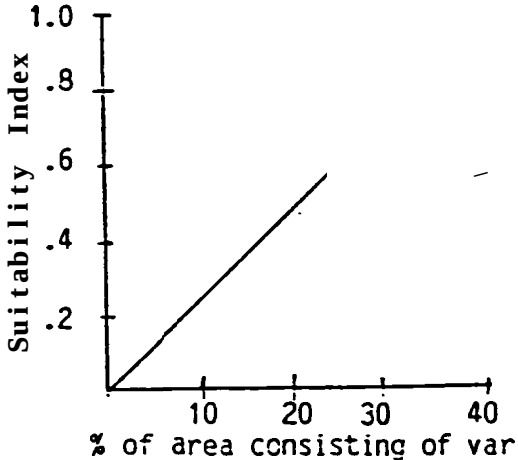
Variable 4: Percent of area consisting of woody evergreen vegetation ≥ 6 feet in height.



V4 Field values:

0%	0
1 - 10%	.2
11 - 20%	.7
>20%	1.0

Variable 5: Percent of area consisting of variable topography.



V5 Field values:

<1%	0
1° - 2%	.3
2° - 3%	.6
3° - 4%	.8
>4%	1.0

$$HSI = \left[\frac{(V1+V2+V3)}{3} \times \frac{(V4+V5)}{2} \right]^{1/2}$$

SAGE GROUSE
(Centrocercus urophasianus)

CHARACTERISTICS

Sage grouse are very distinctive with a black belly, long pointed tail feathers and large size (28 inches in length). Excluding the recently introduced turkey, it is Washing-ton's largest upland game bird, the males attaining a weight of over six pounds. The male is larger and more colorful than the female, with yellow eye combs, black throat and bib, and a large white ruff on its breast. In flight, the dark belly, absence of white outer tail feathers and its much larger size distinguish this bird from the sharp-tailed grouse.

FOOD AND HABITAT REQUIREMENTS

The sage grouse has a specialized digestive system. It possesses a thin-walled stomach adapted to a soft vegetable diet. All other gallinaceous game birds have thick-walled gizzards designed for grinding hard seeds. For this reason the sage grouse is inseparably linked with the sage brush plant for food. About 75% of the diet consists of sagebrush leaves. A minimum of 20% sagebrush cover is optimum. Forbs and insects are also important to the bird's nutritional requirements. Animal foods comprise up to 10% of the diet.

Typical sage grouse habitat consists of lightly-grazed areas of big sagebrush interspersed with grasses and forbs. Wet meadows and wheat fields adjoining such areas are extensively used.

Water is used daily when it is available, although sage grouse can go for long periods without drinking. The best populations are usually found near water.

BREEDING

The sage grouse is promiscuous in its mating habits. Beginning in early spring the males travel up to several miles to a central, open "strutting ground," where each day at dawn and dusk they strut and display before the hens. Courting males fan their tails and rapidly inflate and deflate their air sacs, emitting a loud popping sound. Mating occurs at the strutting ground. These areas, sometimes termed leks, are characterized by bare ground ranging from 0.1 to 100 acres. Leks are usually adjacent to nesting and rearing habitats. The nest is located on the ground, under a sagebrush or in a clump of ryegrass, and usually contains from 7 to 13 eggs. Optimum nesting habitat has a minimum of 20% cover of sagebrush ranging from 7-30 inches in height. Sage grouse use the same leks and nesting sites year after year.

STATUS IN WASHINGTON

The sage grouse was formerly abundant wherever big sagebrush was present in eastern Washington. The large bird and its eggs were an important item in the diet of the early settlers of the area. Destruction of its habitat by plowing and sagebrush control, cattle grazing, over-shooting and perhaps unknown factors have drastically reduced its numbers, and it is now absent from most of its former range.

Sage Grouse
(Centrocercus urophasianus)

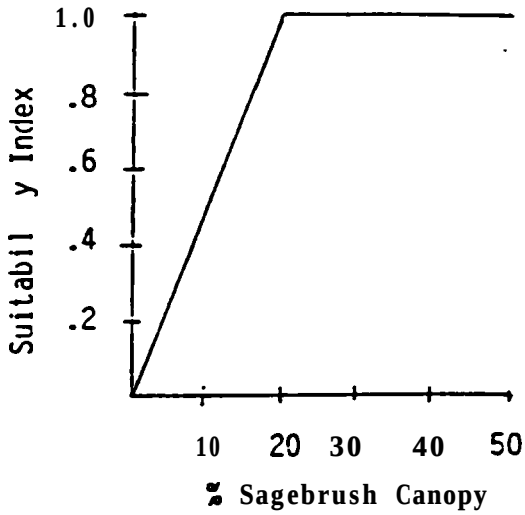
Shrub-Steppe (SS)

Winter Habitat

Variable 1: **Percent sagebrush canopy.**

V1 Field Values:

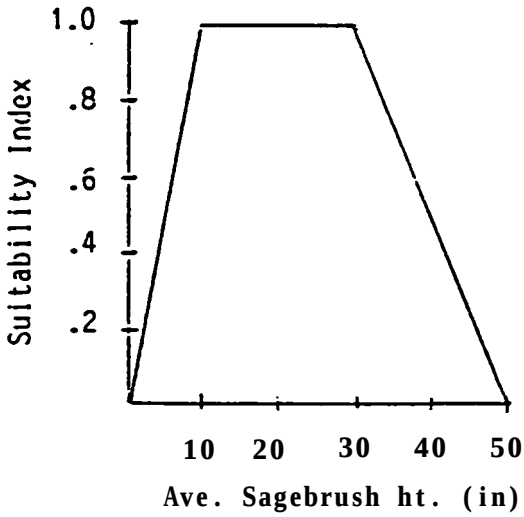
0% = o
1 - 10% = .2
10 - 19% = .7
20 - 50% = 1.0



Variable 2: **Average sagebrush height (in)**

V2 Field values:

0in = 0
1 - 10in.= .5
10 - 30in.= 1.0
31 - 40in.= .7
41 - 50in.= .3
> 50in = o0



HSI = (V1 x V2) ½

SHARP-TAILED GROUSE
(Tympanuchus phasianellus)

CHARACTERISTICS

The sharp-tailed grouse are of moderate size (17 inches) and color, with scaled and spotted underparts, a tail that is mostly white and pointed, and yellowish eye combs.

FOOD AND HABITAT REQUIREMENTS

Sharp-tailed grouse feed primarily on plant materials, although insects are also consumed in spring and summer. Grasses and flowers are important foods in spring and summer. Optimum habitat is 10-25% herbaceous cover. Winter foods consist of buds, twigs and catkins from shrubs and trees. Optimum winter habitat includes greater than 25% bud producing shrubs and trees.

Remnant native habitats containing a mixture of native grasses and brush are most likely to support sharp-tailed grouse. Optimum habitats are composed of a combination of grass, shrub and shrub/grass communities rather than pure stands of any of these community types. Edges between shrubby and grassy cover types are especially important to this species.

Bunchgrass clumps and woody vegetation are used by sharp-tails for cover from weather and predators and for visual isolation of individuals during feeding, resting and nesting activities. Winter roosts are established in snow burrows when snow is deep; however, woody vegetation is used when snow is shallow or crusted. Riparian areas, conifer forest edges and woody ravines also provide important cover for grouse throughout the year.

BREEDING

The breeding season begins in early April with young dispersed by mid-July. Male birds gather at display grounds, or "leks," following receding snow cover when fall-grown forb and grass foods become available. The male's purple neck sacs are inflated during courtship display as he rattles his wing quills to attract females while performing a ritualized courtship dance. Individual birds return to traditional leks and defend the same territories used in previous years. Territory sizes may range from 46-558 square feet with typically 8-12 males present at a lek site.

Sharp-tailed grouse leks are likely to occur in areas of low or sparsely distributed, mixed vegetation. Washington leks are established on barren areas with little or no vegetation within native bunch grass prairies. Nests are built on the ground and may be located beneath a clump of bunchgrass and within 10 feet of brushy cover.

STATUS IN WASHINGTON

In Washington, sharp-tailed grouse live along the edges of native bunchgrass prairies of eastern Washington. The bird was extirpated from portions of its former range, which included California, Oregon and Nevada. The major limiting factor for sharp-tailed grouse is the availability of undisturbed native grass and shrub communities.

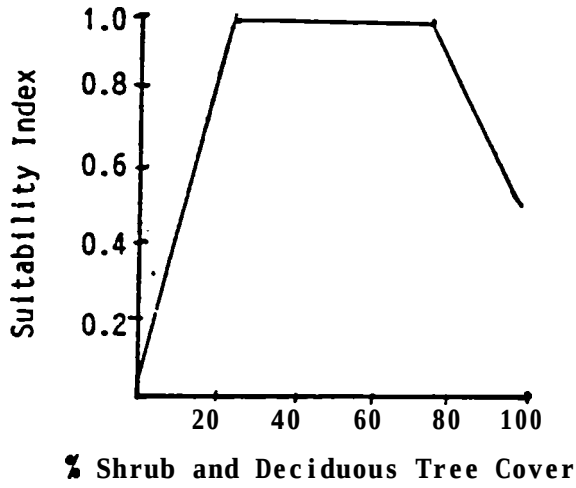
Sharp-Tailed Grouse
(Tympanuchus phasianellus columbianus)
Shrub-Steppe (SS)

Winter Range

Variable 1: % Shrub and Deciduous Tree Crown Cover

V1 Field values:

2: - 25/75% 0.5 1.0
75 - 100% = 0.7
0% = 0

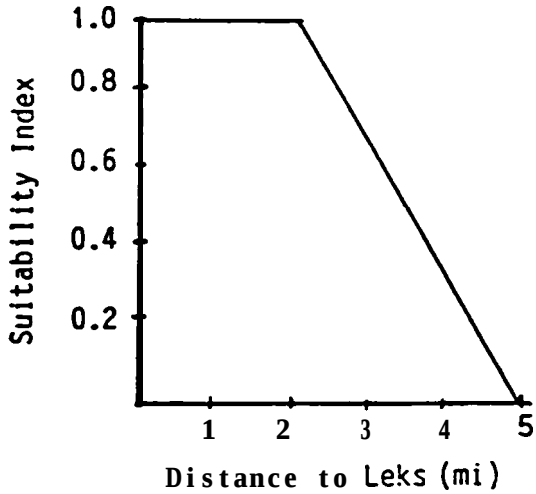


Variable 2: Distance to Leks (mi)

V2 Field values:

0
2.1 - 2mi = 0.8 1.0

3.1 - 4mi = 0.5
4.1 - 5mi = 0.2
> 5mi = 0

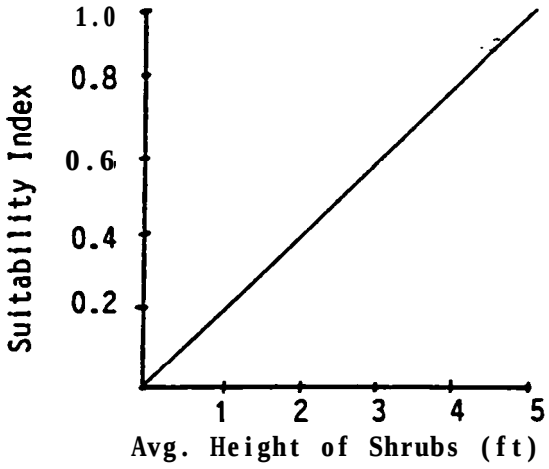


Winter Range

Variable 3: Avg Height of Shrubs (ft)

V3 Field values:

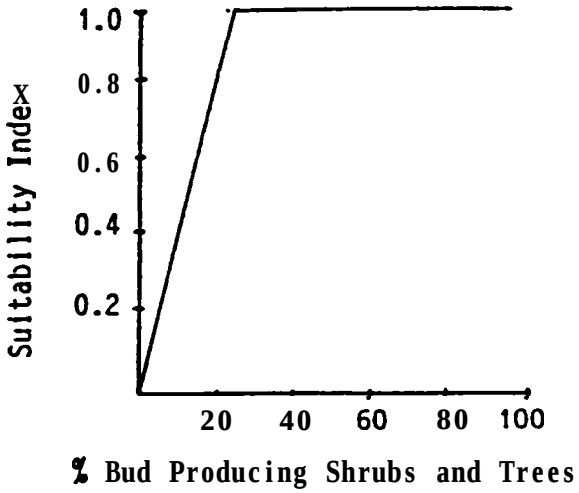
0 - 1	= 0
1.1 - 2	= 0.3
2.1 - 3	= 0.5
3.1 - 4	= 0.7
4.1 - 5	= 0.9
> 5	= 1.0



Variable 4: % Bud Producing Shrubs and Trees

V4 Field values:

0 - 5	= 0
6 - 15	= 0.2
16 - 25	= 0.7
> 25	= 1.0



$$HSI = \frac{(V1 \times V2 \times V3)^{1/2} + V4}{2}$$

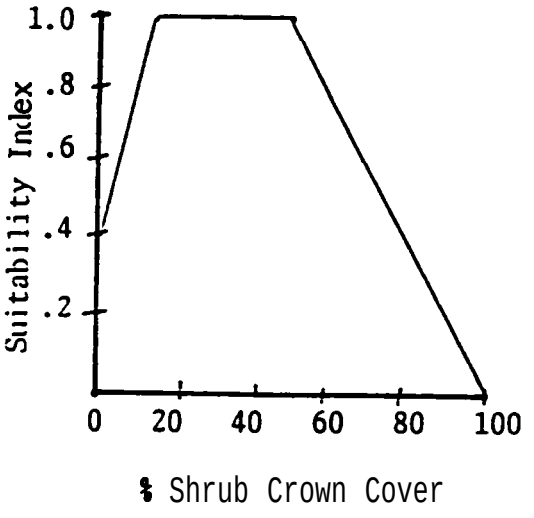
Sharp-Tailed Grouse
(Tympanuchus phasianellus columbianus)
Shrub-Steppe (SS)

Summer Range

Variable 1: % Shrub Crown Cover

V1 Field values:

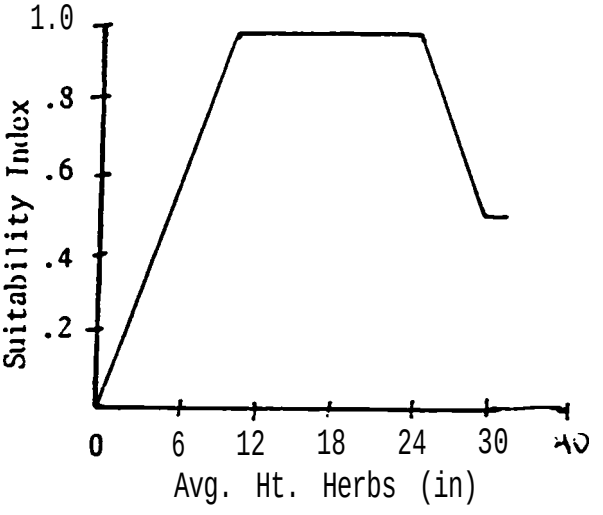
11- 10 = 0.7
51 - 75 = 0.5
76 - 100 = 0.2



Variable 2: Average Height of Herbaceous Vegetation (in)

V2 Field values:

0 - 10.9 = 0.5
11 - 24.9 = 1.0
25 - 40 = 0.7

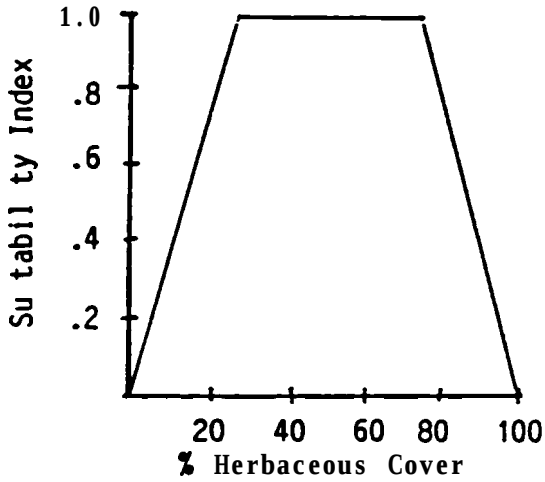


Summer Range

Variable 3: % Herbaceous Cover

V3 Field values:

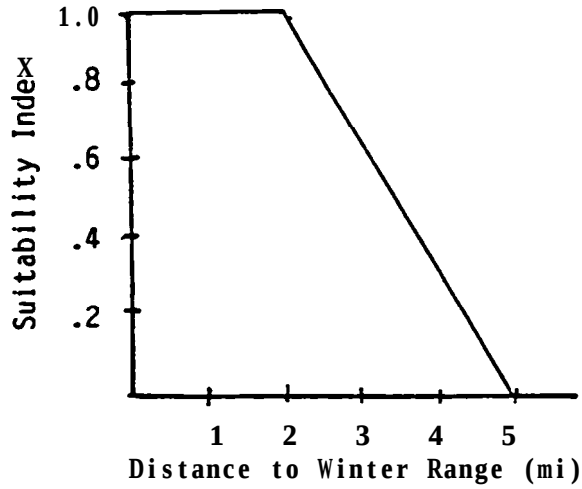
0 - 25 = 0.5
26 - 75 = 1.0
76 - 100 = 0.5



Variable 4: Distance to Winter Range (mi)

V4 Field values:

0 - 2 = 1.0
2.1 - 3 = 0.8
3.1 - 4 = 0.5
4.1 - 5 = 0.2



HSI = (V1+V2+V3+V4) /4

GUIDELINES FOR DETERMINING
HABITAT SUITABILITY INDEX (HSI)

Species: Ring-necked Pheasant

Cover Type: Seasonal Herbland, Cropland, and Scrubland

Ecoregion: 2410

HABITAT RELATIONSHIPS

Range Size

Minimum range size equals 20 ha.

Optimal Habitat Composition

Abundant edges between seasonal herbland, agricultural crops, and woody or dense herbaceous cover. Five to twenty percent of area should be in scrub types.

Life Requisite Values

Food - Related to abundance and availability of grain and weed seeds on a year-round basis [IC_1] (see criteria below).

Water - The availability of permanent water sources is apparently not limiting to pheasants.

Cover - Winter cover is most limiting; non-winter cover is presumed to be not limiting in seasonal herblands. Winter cover is related to the distance from sample site to the nearest woody cover type with dense woody ground cover, or to the nearest dense, tall (>37.5 cm), and winter persistent herbaceous vegetation [IC_2] (see criteria below).

Reproduction - Related to the type of seasonal herbland and human use of the seasonal herbland being evaluated [IC_3], the density of herbaceous vegetation [IC_4], and the average height of herbaceous vegetation [IC_5] (see criteria below). An abundance of ditches, field borders, or roadside edges that are not disturbed by mowing, burning, or grazing may compensate for otherwise low reproductive value.

Interspersion - Interspersion of winter cover and seasonal herbland is considered under Cover. Optimal habitat conditions are found when edges between,feeding areas and woody or dense herbaceous cover are abundant [IC_6] (see criteria below).

Mechanism to Determine the Habitat Suitability Index (HSI)

The HSI equals the lowest of the Life Requisite Values.

HSI ($\leq$ 1.0) = _____

HABITAT EVALUATION CRITERIA

Food - Related primarily to the abundance and availability of grain crops; weedy fields, roadside vegetation, or field edges may compensate for a lack of grain crops. Evaluate food primarily by using the following criteria.

Food Value is a function of:

[IC_1] The availability of grain and weed seeds within 1.6 km of sample site (consider year-round food availability).

a) Grain and weed seeds abundant and readily available . . . . . (0-8-1.0 rating)
b) Grain and'weed seeds scattered and not abundant (consider value of compensating food sources, as described above) I..... (0.3-0.7 rating)
c) Grain and weed seeds scarce or not available (e.g., as a result of prevailing agricultural practices) (consider value of compensating food sources, as described above) ..... (0.0-0.2 rating)

Food Value = _____

Cover - Winter cover is most limiting to pheasants. It is-presumed that summer cover in seasonal herbland is not limiting. Evaluate winter cover primarily by using the following criteria.

Cover Value is a function of:

[IC_2] The distance to the nearest scrubland with dense woody ground cover, or the nearest treeland with dense woody ground cover, or the nearest dense, tall (>37.5 *cm*), and winter persistent herbaceous vegetation.

a) Less than 100 m ..... (0.9-1.0 rating)
b) 100-300 m ..... (0.4-0.8 rating)
c) Greater than 300 m ..... (0.0-0.3 rating)

Cover Value = _____

Reproduction - Evaluate reproductive value primarily by using the following criteria.

Reproductive Value is a function of:

[IC_3] The type of seasonal herbland being evaluated. (Note: If ditches, field borders, or roadside edges are not burned or mowed, the resulting nesting cover may compensate for otherwise low reproductive value).

a) Seasonal herbland that is not mowed, plowed, grazed, or flood irrigated during pheasant nesting season (late May to mid-July) . . . . . (0.8-1.0 rating)
b) Seasonal herbland that is mowed, plowed, grazed or flood irrigated during the nesting season, but not until after July 1 ..... (0.4-0.7 rating)
c) Seasonal herbland that is moderately grazed throughout the nesting season . (0.2-0.5 rating)
d) Seasonal herbland that is heavily grazed throughout the nesting season, or is mowed, plowed, or flood irrigated between late May and July 1 ..... (0.0-0.1 rating)

[IC_4] The herbaceous canopy cover (estimated for late May to mid-July).

a) SO-80% ..... (0.8-1.0 rating)
b) Greater than 86% or between 20% and 50% ..... (0.3-0.7 rating)
c) Less than 20% ..... (0-0-0.2 rating)

[IC_5] The average height of herbaceous vegetation (estimated for late May to mid-July).

a) Greater than 45 cm ..... (0.7-1.0 rating)
b) 25-45 cm ..... (0.2-0.6 rating)
c) Less than 25 cm ..... (0-0-0.1 rating)

Reproductive Value = _____

Interspersion - Evaluate interspersion value primarily by using the following criteria.

Interspersion Value is a function of:

[IC_6] The abundance of edges between feeding areas (weedy fields, grain fields) and cover areas (treeland, scrubland, or fencerows with dense woody ground cover, or dense and tall herbaceous vegetation)

a) Feeding and cover areas well interspersed throughout area in small blocks; edges abundant . . . . . (0.8-1. 0 rating)

b) Either feeding areas or cover areas are present as large units; amount of edge considerably less than choice (a) ..... (0. 3-0. 7 rating)

c) Both feeding areas and cover areas occur as large units; amount of edge is minimal ..... (0. 0-0. 2 rating)

Interspersion Value = _____

Other Considerations

In addition to those inventory characteristics identified as being important for the ring-necked pheasant, there may still be other pertinent evaluation criteria obvious only at an on-site inspection. All criteria identified as being unique to a specific site must be incorporated (and documented) into the appropriate life requisite category as each situation dictates, and considered when determining the HSI.

If any criteria listed are not applicable in a particular situation, do not use in determining the life requisite value or the HSI.

August 12, 1991

DRAFT

Habitat Suitability Index Model:

Bobcat

by

Tim Bodurtha

Habitat Use Information: Bobcat (Felis rufus)

General

The bobcat can be found throughout the contiguous United States, southern Canada, and northern Mexico (Young 1958). Extreme variations in habitat types accompany the locational variations which can range from swamps to deserts to mountain ranges (Young 1958).

Food Requirements

In general, like most predators, bobcats are opportunists and k-ill attempt to take most anything available including insects, fish, reptiles, amphibians birds, and mammals. Mammalian prey, however, is the most important group.

Bobcats feed primarily on rabbits and hares (lagomorphs) as inferred from studies which showed relatively high percentage in their diets even rhen prey populations were low (Beasom and Moore 1977, Fritts and Sealander 1978). Knick (1990) found that during a lagomorph decline bobcat home ranges expanded to areas that contained alternate prey, although energy returns from these prey sources were suboptimal. Mountain beavers (Apolodontia rufa) and snowshoe hares (Lepus americanus) were the primary foods of bobcats in western Washington (Knick et al. 1984). Other prey species of the bobcat include deer (Odocoileus sp.), porcupine (Erethizon dorsatum), squirrels amd marmots (Family Scuridae), pocket gophers (Family Geomyidae), woodrats (Neotoma sp.), beaver (Castor canadensis), pocket mice and voles (Family Heteromyidae), and varoius birds. The cottontail rabbit (Sylvilanus sp.) appears to be the principle prey of the bobcat throughout its range. In the west, other rodents, especially woodrats, may be important prey items when cottontails are not abundant (McCord and Cardoza 1982).

The importance of the primary prey species in bobcat diets necessitates consideration of the general food and habitat requirements of the prey. Prey items such as mice, squirrels, and grouse (Family Tetraonidae), may be important in particular cover types that are less suitable for rabbits or hares. Voles were the most frequent item in bobcat scats in central Idaho in winter and summer (Koehler and Hornocker 1989). In winter bobcats used lower elevation, open areas, and in summer used higher elevations and a variety of forest habitats. Knowles (1981) observed bobcats preferred dense understories where prey were most abundant. Litvaitis et al. (1986) reported that bobcats avoided sparse understories and that hare densities appeared to be greatest in dense understories regardless of whether a hardwood or softwood understory.

Water Requirements

Water does not appear to be a major factor in habitat distribution. However, no literature was found which addressed the relationships of bobcats to free water.

Cover Requirements

In its northern range the bobcat is adapted to a wide variety of cover types which generally includes broken country, including swamps, conifer stands and rocky ledges (McCord and Cordoza 1982). Rollings (1945) believed that prey abundance, protection from severe weather, availability of rest areas, dense cover, and freedom from disturbance were all factors in bobcat habitat selection. Bailey (1974) observed that broken, rocky terrain was a significant element of bobcat habitat in southeast Idaho.

In regions that contain dissected plateaus, the upslope, broken terrain along the rims between the top of the plateaus and the canyon bottomlands contain the best habitat for bobcat (pers. comm., Steve Knick). The amount of this habitat is probably the major limiting factor for bobcat populations in regions of scabland topography because of the territorial habits of females. The number of female bobcats that can occupy a territory is likely determined by the size and extent of the broken terrain and rocky escarpments of the area (pers. comm., Steve Knick). Bobcats may estend their home ranges into higher elevation areas during summer if higher elevation summer habitats are available: but retreat to low elevations in winter due to snow cover. Low elevation riparian areas may be very important during these times (pers. comm., David Brittell).

Habitat features in all cover types are related to hunting and stalking. The hunting habits of bobcats are typical of most members of the cat family and prey may be attacked when moving or stationary. Stalking and ambush tactics are commonly used to overtake their prey (Rollings 1945, Young 1958). Sufficient camouflage cover, in the form of shrubs, trees, and large rocks, is needed to conceal the bobcat until within a short distance from its prey (Rollings 1945, Young 1958).

Ledges appear to be the most important terrain feature in bobcat habitat in the northern portion of its range. Ledges were the most critical terrain feature that provided protective cover from weather and harrassment (McCord 1974). Courtship activities were always around ledges (McCord 1974). Rocky terrain was also considered an important habitat component in Missouri (Hamilton 1982) and in southeast Idaho (Baily 197-I).

Rollings (1945) found that bobcats in Minnesota occupy both upland and lowland habitats during summer, but preferred dense conifer forests in winter. In central Idaho, wintering bobcats selected habitats that contained rocky terrain with an overstory over habitats that did not (Koehler and Hornocher 19891.

Diurnal resting areas are temporary hiding places used during the day. These sites are usually occupied for one night (Rollings 1945, Young 19583. Commonly mentioned resting sites include rockpiles, rock outcrops, dense vegetation, and hollow logs (Young 1958). Anderson (1990) indicated that bobcat diurnal loafing sites in southeast Colorado were primarily steep-sloped, rocky areas with dense vertical cover.

Reproductive Requirements

1:e importance of rockpiles, cakes, or broken rocky ledges for deas is weil documentec.. a cover type containing these features would i ikely sat isfy reproductive needs (pers. comm., Steve Knick). These areas are used for refuge, breeding, raising young, and shelter. Den sites are often very similar to diurnal resting sites (Rollings 1945, Young 1958). In California, small rocky areas above the desert floor were used for denning and sanctuaries (Zezutak and Schwal. 1979).

Yodel Applicabi 1 ity

Geographic Area and Cover Type

This model was specif ically developed for use on the Chief Joseph Dam Wildlife Mitigation Planning Habitat Evaluation Procedure (HEP) study and applies only to the steep, canyon- 1 ike topography associated with the rim and trough of the Columbia River corridor that cuts through the Columbia Plateau in north-central Yashington at Rufus Woods Lake. Thr physiography of the canyon is dominated by level to moderately sloping terraces, connected by rol ling terrain or steep sloping escarpments. Many of these escarpments have eroded away forming extremely rugged breaks with complex microrelief. Steep granite outcrops are common at lower elevations, whereas basalt outcrops and talus are typical at higher elevations. The canyon formed by the Columbia River averages 1476 feet in depth, and 1.9 to 3.7 miles in width. Elevations range from 955 feet on the Rufus Woods Lake to 2625 feet on the plateau above the cans-on, to over 3937 feet on the foothills to the northeast.

Within the context of the study, use of the model is for awns defined as the 'rock' habitat type (cover type). These areas were characterized as steep difficult topography, mainly on north facing slopes or as major rocky outcrops. Grazing has excluded from these sites. Vegetat ion included deep-rooted shrubs, principally ❑ Ot.k orange (Philadelphus lewesii), as well as forbs such as arrowleaf balsamroot (Balsamorhiza sagi ttata) and bunchgrasses, primarily bluebunch wheatgrass (Agropyron spicatum).

The vegetation of the region is typical of arid grass-shrublands dominated by big sagebrush/grassland communities. Large areas of the canyon are dominated by basin big sagebrush (Artemesia tridentata). Bi tterbrush (Purshia tridentata) occurs commonly at lower elevations on deep, sandy or gravelly soils. Three-tip sagebrush (Artemesia tripartita) is dominant on the more steeply slopes and shallow soils of the canyon along the rim of the plateau.

The cooler, moister climate of the plateaun combination with deep, fertil;: soi ls favors bunchgrass communities, primarily bluebunch wheatgrass, Idaho fescue (Festuca idahoensis), and needle-and-thread grass (Stipa comata). Cheatgrass (Bromus Atectorum) is often a dominant component of ail these steppe communities, especially on more disturbed sites.

Throughout the area, giant wi ldrye (Elymus cinereus) is found in low-lying areas where soil moister and alkalinity is high. Deci duous shrubs such as mock orange, redosier dogwood (Cornus stolonifera), and serviceberry (Alemanchier ++hifolia! are common in seasonally moist draws and at the base of rock slides and cliffs where water collects. Perennial water courses and seeps support a

number of deciduous tree species including quaking aspen (Populus tremuloides), cottonwood (Populus trichocarpa), hawthorn (Crataegus douglasii), and mountain alder (Alnus incana). Ponderosa pine (Pinus ponderosa) and Douglas fir (Psuedotuga douglasii) are very limited in distribution, occurring only on the very steep, north-facing slopes.

Season

This model represents year-round habitat needs for bobcats in canyon-like habitats of the Columbia River trough in north-central Washington.

Minimum Habitat Area

So published data could be found on home range sizes for bobcats inhabiting the Columbia River trough in north-central Washington. However, the areas of 'rock' habitat type along the river are not apparently too small or isolated to support bobcats (pers comm. George Brady). Long narrow coulees or draws that extend upslope from the river corridor are large enough and extensive enough to preclude these habitats from becoming too isolated from other rock habitats. Athough agriculture is widespread on the plateaus, there appears to be enough broken terrain to allow dispersal. Furthermore, about 150,000 acres of agricultural lands in Douglas County are now under the Conservation Reserve Program (CRP) which is slated to revert this land back into better wildlife habitat which could aid dispersal of bobcats in Douglas County (pers. comm. George Rrady).

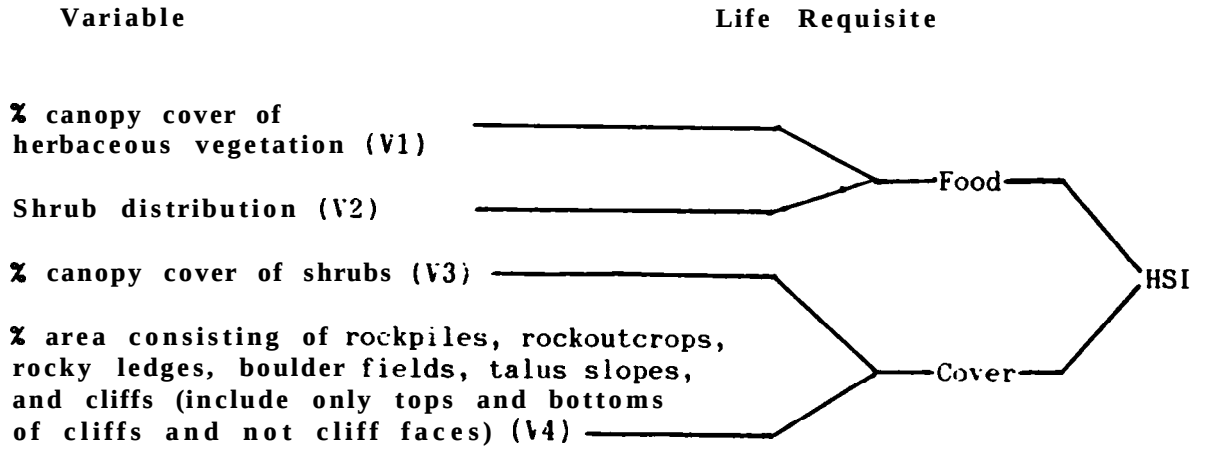
Yodel Description

Model Outputs

This model for bobcats applies to the steep, rocky, canyonland habitat of the Columbia River corridor in the sagebrush steppe region of the Columbia Plateau in north-central Washington.

Variables

Vegetation components within the rock cover type can be used assuming there is a direct relationship with prey abundance. Food availability is defined in this model by areas of herbaceous/shrubby vegetation. Cover and reproduc t ive needs are assumed to be satisfied by the habitat structure within the rock cover type.



Food Requirement

This model assumes the primary prey species for bobcats are bushy-tailed woodrats (Neotoma cinereaj and mountain cottontail rabbits (Sylvilagus nuttalli). Bushy-tailed woodrats are likey the main food source within the study area and within the rock habitat type (pers. comm., George Brady). It's also very likely that cottontail rabbits are an important bobcat prey that inhabits the area and this habitat type. Other small mammals such as mice, marmots, gophers, and aquatic fur-bearers are probably preyed upon to a lesser extent.

This model also assumes that bobcat prey are supported by areas of herbaceous and shrubby vegetation. Bushy-tailed woodrats, which commonly occur in rocky areas, feed upon the green portions of forbs and shrubs, but also eat twigs, nuts, and seeds. Furthermore, woodrats store large quantities of forbs and shrubs for the upcoming winter (Zeveloff and Collett 1988).

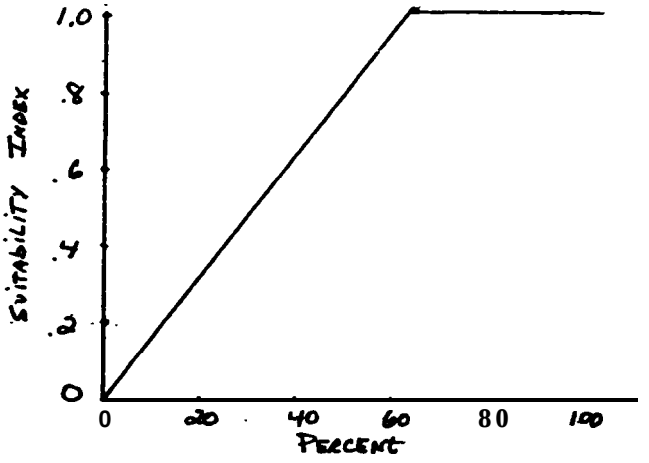
Mountain cottontails occur in thick sagebrush stands where there is prevalency of rocky hills and canyon country (Zeveloff and Collett 1988). They are also typically found in brushy areas that, provide concealment from predators and sites to build burrows. Within the sagebrush region, the most inportant food for mountain cottontails in all seasons is sagebrush. Grasses are preferred in the spring and susmer, however, succulent weedy forbs may also be a significant food source (Chapman et al. 1982).

Variable 1. Percent canopy cover of herbaceous vegetation

Assumes :

(1) 65% cover provided optimum habitat for rodents/lagomorphs.

(2) 100% cover will not interfere with bobcats ability to find prey



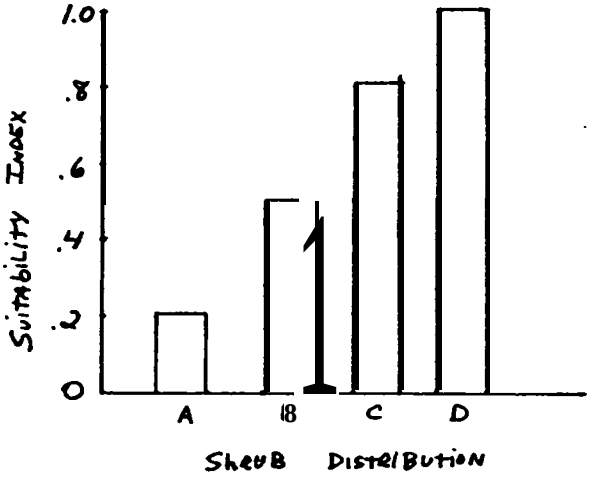
Variable 2. Shrub distribution

Assumes:

(1) dense shrub stands pro\-ide winter food, escape cover, burrow sites, and protection from inclement weather.

(2) dense stands of shrubs provide concealment for bobcat stalking and ambushing.

A - none to few shrubs
B - scattered single shrubs
C - scattered groups of shrubs
D - continuous dense shrubby vegetation



Cover/Reproduction Requirements

Based on information inferred from other studies in different habitats, and from interviews with local bobcat experts, the following characteristics are assumed to provide the optimum cover components within the 'rock' habitat type.

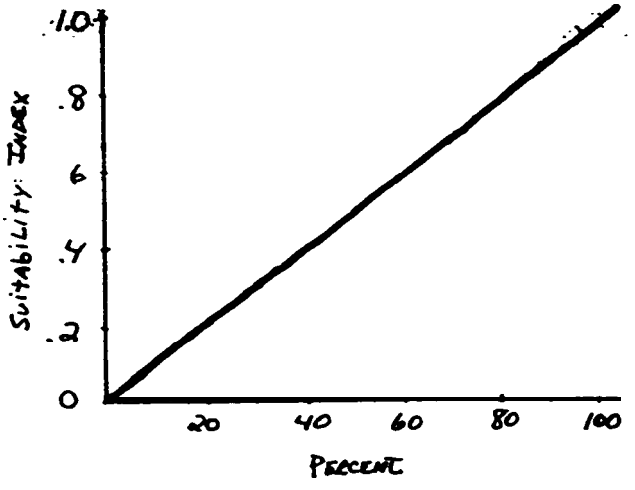
Rocky terrain is the most important habitat component. Rocky terrain with the addition of trees and shrubs, particularly shrubs, intermixed would enhance the area for bobcats by providing stalking and ambush cover, thermal breaks for protection from inclement weather, and increased availability of prey species. Knowles (19851 showed a close association between vegetation density and bobcat use, finding that bobcats selected habitats with greater than 52% vertical cover. Furthermore, a rocky ledge factor should provide some indication of the available rock dens and diurnal resting sites. A good den site would be one that is sheltered and inaccessible or easily protected.

Variable 3. Percent canopy cover of shrubs

Assumes :

(1) 100% shrub cover does not limit bobcat USC'.

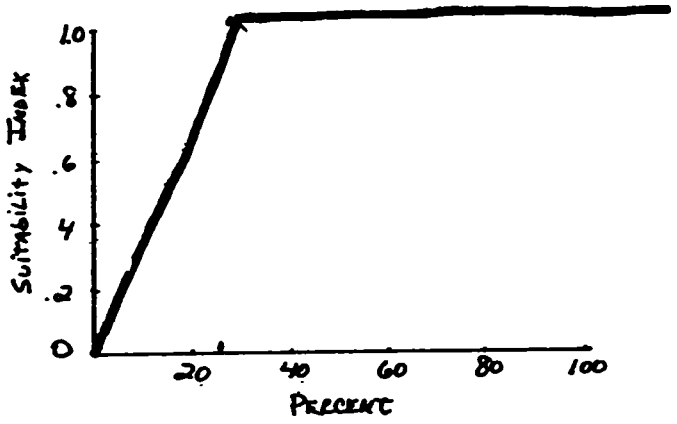
(2) Increasing shrub cover is directly related to optimum cover for bobcats



Variable 4. Percent of area comprised of rockpiles, rock outcrops, rocky ledges, boulder fields, talus slopes and cliffs [include only tops and bottoms of cliffs and not cliff faces (pers comm., Steve Knick)].

Assumes :

(1) Bobcats prefer rocky or broken terrain.



Model Relationships

In order to calculate suitability indices for food and for cover, the variables for each life requisite were combined into an equation. Because food requirements and cover/reproductive requirements are of equal importance, the SI's were derived to express each life requisite as separate values for the overall HSI determination (see below).

Suitability Indices

Food

$$SI_f = \frac{V1 \text{ t } 2V2}{3}$$

Cover/reproduction

$$SI_{c/r} = \frac{V3 \text{ t } 2V4}{3}$$

Determining Overall Habitat Suitability Index (HSI)

Compare the SI values for life requisite. Based on the limiting factor concept the HSI is equal to the lowest life requisite value for bobcat in the study area.

General Assumptions

Food

A. Cover to allow bobcats to stalk and ambush prey is important.

B. Prey density positively influences quality of habitat for bobcats.

c. Majority of bobcat prey species are associated with grass/forb and shrub areas.

Cover

A. Bobcats prefer the rock habitat type to meet cover requirements in the study area.

B. Shrub cover enhances bobcat cover components within the rock habitat type.

C. Rocky terrain is the most important cover component within the rock habitat type.

D. Bobcats require rest shelters.

E. The interspersion of shrubs and rocky areas within the rock habitat type creates quality micro-habitat sites by bobcats of the area.

Reproduction

A. If cover requirements are met, reproduction will not be limiting.

Water

A. Water will not be limiting in the study area in view of the proximity of Rufus Woods Lake and the mobility of bobcats.

Assumptions Used in Applying the Bobcat Model

A. The rock habitat type were well dispersed throughout the study area.

B. Bobcat preferred the rock habitat type within the study area.

C. The terrain of the rock habitat type was assumed to be adequately diverse, rocky, and broken and supported bobcats in the study area.

D. A prey base for bobcats exists in the study area and its abundance is related to the extent of herbaceous and shrubby vegetation.

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APPENDIX E-1
Summary - Habitat Evaluation Procedure Results of Inundated Acres

		Pre-Construction Original Area		Post Construction Pre-10 ft. pool rise		Current Status Inundated Area	
Indicator Species / Wildlife Habitat	Habitat Suitability Index	Acres of Habitat	Habitat Units	Acres of Habitat	Habitat Units	Acres of Habitat	Habitat Units
Lesser Scaup / Feeding / Lacustrine	a96	0.00	0.00	1500.00	1440.00	1500.00	1440.w
Lesser Scaup / Resting / Lacustrine	0.00	0.00	0.00	6426.00	0.00	7088.00	0.00
Lewis' Woodpecker / Mixed Forest	0.74	93.00	68.82	0.00	0.00	0.00	0.00
Lewis' Woodpecker / Ponderosa Pine Savanna	0.60	346.00	207.60	0.00	0.00	0.00	0.00
Mink / Riverine	a52	1744.00	906.88	0.00	0.00	0.00	0.00
Yellow Warbler / Palustrine	0.63	90.00	56.70	0.00	0.00	0.00	0.00
Mule Deer / Shrub-Steppe	a71	1463.00	1038.73	0.00	0.00	0.00	0.00
Mule Deer / Rockland	0.77	355.00	273.35	0.00	0.00	0.00	0.00
Mule Deer / Mixed Forest	0.81	93.00	75.33	0.00	0.00	0.00	0.00
Mule Deer / Ponderosa Pine Savanna	0.89	346.00	307.94	0.00	0.00	0.00	0.00
Sharp-tailed Grouse / Shrub-Steppe Summer Range	0.85	1463.00	124355	0.00	0.00	0.00	0.00
Sharp-tailed Grouse / Rockland Summer Range	0.92	355.00	326.60	0.00	0.00	0.00	0.00
Sharp-tailed Grouse / Riparian Winter Range	0.74	64aw	479.52	0.00	0.00	0.00	0.00
Sage Grouse / Shrub-Steppe	0.48	1463.00	7Q2.24	0.00	0.00	0.00	0.00
Sage Grouse / Rockland	0.74	355.00	262.70	0.00	0.00	0.00	0.00
Spotted Sandpiper / Sand/Gravel/Cobble	0.85	1167.00	991.95	0.00	0.00	0.00	0.00
Spotted Sandpiper / Island / Sandbar	1.00	337.w	337.00	96.00	96.00	39.00	39.00
Canada Goose / Island / Sandbar	a89	337.00	299.93	96.00	85.44	39.00	34.71
Ring-necked Pheasant / Agriculture	a64	366.00	234.24	0.00	0.00	0.00	0.00
Bobcat / Rock	a65	231.00	150.15	0.00	0.00	0.00	0.00
Bobcat / Rockland	a66	355.00	234.30	0.00	0.00	0.00	0.00

APPENDIX E-2 1/

Summary - Habitat Evaluation Procedure Results of Acres Affected by Construction

Indicator Species / Wildlife Habitat	Pre-Construction - Original Habitat Suitability Index	Pre-Construction - Acres Of Habitat	Pre-Construction - Habitat Units	Current Status Impacted Area - Current Habitat Suitability Index	Current Status Impacted Area - Acres of Habitat	Current Status Impacted Area - Habitat Units
Lesser Scaup / Feeding / Lacustrine	0.96	0.00	0.00			
Lesser Scaup / Resting / Lacustrine	0.00	0.00	0.00			
Lewis' Woodpecker / Mixed Forest	0.74	13.00	9.62			
Lewis' Woodpecker / Ponderosa Pine Savanna	0.60	0.00	0.00			
Mink / Riverine	0.52	34.00	17.68	0.16	26.00	4.16
Yellow Warbler / Palustrine	0.63	3.00	1.89	0.18	3.00	0.54
Mule Deer / Shrub-Steppe	0.71	531.00	451.35	0.29	313.00	90.77
Mule Deer / Rockland	0.77	0.00	0.00			
Mule Deer / Mixed Forest	0.81	13.00	10.53			
Mule Deer / Ponderosa Pine Savanna	0.89	0.00	0.00			
Sharp-tailed Grouse / Shrub-Steppe Summer Range	0.85	531.00	451.35	0.72	313.00	225.35
Sharp-tailed Grouse / Rockland Summer Range	OS?	0.00	0.00			
Sharp-tailed Grouse / Riparian Winter Range	0.74	21.00	15.54	0.10	11.00	1.10
Sage Grouse / Shrub-Steppe	0.49	531.00	254.88	0.13	313.00	40.69
Sage Grouse / Rockland	0.74	0.00	0.00			
Spotted Sandpiper / Sand/Gravel/Cobble	0.85	48.w	40.00	0.59	31.00	1829
Spotted Sandpiper / Island / Sandbar	1.00	1.00	1.00	0.50	4.00	W
Canada Goose / Island / Sandbar	0.89	1.00	0.89	0.55	4.00	W
Ring-necked Pheasant / Agriculture	0.64	48.00	30.72	0.37	71.00	2627
Bobcat / Rock	0.65	25.00	1625			
Bobcat / Rockland	0.66	0.00	0.00			

1/ Blank spaces represent habitats no longer present in this part of the study area.

AND
COLVILLE CONFEDERATED TRIBES

SlRQWKYAEDEES O-
BBcglvgD- —— PUBLIC REVIEW PROCESS

JANUARY 31, 1992

INTRODUCTION

In 1980, when Congress passed the Northwest Power Act, it recognized the need and obligation to mitigate for wildlife losses caused by the operation and development of hydroelectric dams in the Columbia Basin. The Northwest Power Planning Council (NPPC) was mandated to develop a program to "protect, mitigate, and enhance fish and wildlife" in the Columbia River Basin and did so in 1982 when it established the Columbia Basin Fish and Wildlife Program. The resulting planning process was designed to identify specific impacts to wildlife and to recommend appropriate mitigation measures.

In October 1989, NPPC amended its Fish and Wildlife Program and adopted an interim goal for wildlife mitigation. NPPC's Wildlife Rule directed the resource agencies and tribes that completed the Chief Joseph Wildlife Habitat Impact Assessment, to develop generic wildlife mitigation goals, and to conduct appropriate public involvement activities including: consultations with local government, public meetings in which loss statement and mitigation planning process are explained, distribution of, and public comments on, draft mitigation goals, and response to significant comments.

In 1992, the Washington Department of Wildlife (WDW), Colville Confederated Tribes (CCT), and U.S. Fish and Wildlife Service (USFWS) completed and submitted the Chief Joseph Dam Wildlife Habitat Impact Assessment and generic wildlife mitigation objectives to NPPC for consideration.

Following are WDW and CCT responses to significant comments and other issues raised during the required public input process completed in January 1992. Responses addressed major comments received in writing from 40 individuals and/or organizations, as well as significant input from the 123 people who attended formal consultations and public hearings. In general, the comments received reflect a sincere public interest in the wildlife mitigation process, not only for Chief Joseph Dam but, for all hydropower facilities along the Columbia River and its tributaries. Opinions varied among commentors. Some individuals felt strongly that the full extent of wildlife impacts should be addressed as soon as feasible and that the development of mitigation objectives should best be left to the wildlife professionals. Others questioned the justification for any wildlife mitigation program, feeling that net benefits had resulted from the construction and operation of Chief Joseph Dam.

Many commentors concentrated their input on the implementation aspects **of** mitigation rather than on the draft mitigation objectives, as requested.

These and other significant comments are addressed and categorized into **the** following sections: 1) Mitigation, 2) Wildlife, 3) Effects of Hydroelectric **Power,** 4) Irrigation and Agriculture, and 5) Tribal Concerns.

1. Mitigation

Comment: (habitat units)

Some commentors questioned the use of habitat units for mitigation, feeling **an** acre-for-acre approach was more acceptable and easier to understand. **Others stated** mitigation costs were too high, and that mitigation actions should **take** place in the local area. Still others felt that the land which the Corps of Engineers (COE) manages for wildlife, in conjunction with Chief Joseph Dam, exceeded the mitigation requirements for the 1981 ten-foot pool rise and **should** be credited towards addressing the habitat losses associated with the original construction and operation of Chief Joseph Dam.

In addition, some commentors felt that wildlife populations should be addressed instead of habitat units.

Response;

The NPPC Wildlife Rule identifies the Habitat Evaluation Procedure (HEP) as the preferred scientific method to determine net impacts to wildlife from federal hydropower facilities along the Columbia River. This method, developed by the USFWS, is nationally recognized as the most up to date tool to measure the quality and quantity of habitat affected.

Under the Wildlife Rule, achievement of the biological objectives will be done in the most cost effective manner, measuring net impacts to wildlife. bosses will be mitigated in-place, in-kind, where practical.

Lands owned or controlled by the COE, in close proximity to Rufus Woods Lake, could potentially be considered for future wildlife mitigation actions under the Northwest Power Act. The COE Draft Master Plan for Chief Joseph Dam utilizes the following land classification: A) Operations Area, B) Multiple Resource Areas, and C) Wildlife Easement Areas.

Within these categories it was determined that some potential for future mitigation could exist. These areas would likely have to be submitted through the Implementation Planning Process for conformance to Wildlife Rule mitigation standards to ensure the highest wildlife needs are being addressed.

In addition, numerous policy decisions must be made by COE, Bonneville Power Administration (BPA), NPPC, WDW, CCT, and USFWS regarding the wildlife **mitigation** crediting issue. The COE must also make a decision on which, if any, of these potential mitigation areas would be dedicated to wildlife in perpetuity. The relationship of lands secured under the Fish and Wildlife Coordination Act **must** also be addressed.

Once these policy decisions have been made and site-specific analysis completed, some of these COE lands, and subsequent enhancements to them, could potentially be credited against the baseline wildlife losses statement developed in the Wildlife Habitat Impact Assessment Chief Joseph Dam Project report.

Consideration of existing lands managed by the COE will be addressed during the next phase of the Planning Process for Chief Joseph Dam Mitigation. Site specific mitigation actions will be the focus of the implementation phase of planning which will occur after the NPPC has accepted wildlife habitat losses and objectives developed for Chief Joseph Dam. As has been the case with Grand Coulee Dam, all interested parties including the Grand Coulee/Chief Joseph Wildlife Mitigation Steering Committee will be involved in the development of mitigation project proposals. The Steering Committee was specifically formed to represent the input and concerns of the local communities and elected officials.

Wildlife populations are constantly changing and subject to changes in their environment, so they are a product of that environment. It would be impossible to accurately detemine the numbers of wildlife present when the Chief Joseph Dam was originally constructed over 40 years ago.

At present, there have been no lands specifically purchased for wildlife mitigation to address impacts caused by the original construction and operation of Chief Joseph Dam.

comment: (public involvement)

Some commentors felt that the general public had not been given sufficient opportunity to become involved with, or informed about, Chief Joseph Wildlife Mitigation Planning.

Response;

WDW and CCT far exceeded the public involvement process as outlined by the NPPC's Wildlife Rule. The effort was incorporated into the Grand Coulee/Chief Joseph Wildlife Mitigation Public Outreach Program. This outreach program has been identified by NPPC as the prototype for the entire Columbia River Basin. Numerous local elected officials have also identified this public involvement as exemplary. The informal and formal opportunities provided to the public during the Chief Joseph Wildlife Mitigation Planning process have been both extensive and reasonable to this point. These opportunities included discussions with local landowners, consultations with local elected officials, briefings to the Grand Coulee/Chief Joseph Wildlife Mitigation Steering Committee, an extensive mailing list, three public meetings, updates to various local organizations, advertisements on TV, in newspapers, and on local radio, and the mailing of over 600 copies of the draft report describing in detail the Chief Joseph Wildlife Mitigation Planning Study. During the course of the study, comments on plans, loss statements and mitigation objectives were strongly encouraged. Extensive verbal and written comments were received during the study.

Comment: (implementation concerns)

Some commentors suggested the study was a waste of time and taxpayers money and that mitigation **was** unnecessary. Several commentors were concerned that aquisition of private lands would take lands off tax rolls, thereby causing revenue problems for the counties involved.

Other commentors felt that mitigation of wildlife losses was justifiable, agreed with the loss assessment and felt every attempt should be made to restore the area and wildlife populations to pre-dam status, immediately.

Response;

Several NPPC wildlife mitigation standards deal with concerns over additions to public land ownership and impacts on local communities, such as reduction or loss of local government tax base. These concerns will be taken into consideration during the implementation phase of the planning process.

Ratepayers through BPA, fund mitigation to address wildlife habitat losses caused by hydroelectric power generation. Such mitigation was mandated by Congress in 1980 with the passage of the Northwest Power Act. It should also be noted that over 40 years have passed since the original construction began without any attempts at compensation for resultant wildlife habitat impacts.

2. Wildlife

Comments: (pheasants)

Several commentors questioned the position of pheasants on the non-tribal prioritized species list, feeling a lower priority was justified. Other **com**mentors supported the use of pheasants as a target species representing wildlife associated with agricultural lands and adjacent riparian habitat.

Other commentors believed that it was inappropriate to use an introduced species during the study and would not support mitigation for agricultural lands in general.

Response:

The ring-necked pheasant is an introduced species in Washington but was present when the Chief Joseph Dam was originally constructed. A significant amount of agricultural land habitat was impacted by the filling of the reservoir, and by original construction sites. The interagency technical work **group,** which developed the Chief Joseph wildlife mitigation objectives, opted to use ring-necked pheasant to represent the original farmland wildlife and habitat. One primary consideration in the selection of the ring-necked pheasant to represent agricultural habitat impacts, was the level of local interest and concern with that species.

The nontribal ring-necked pheasant mitigation objective was moved to a lower priority position due to public comments received and NPPC Upper Columbia River **Subbasin** Wildlife Hitigation goals.

The emphasis of any associated mitigation projects would be on the permanent protection, and/or permanent enhancement, of upland range/agriculture foraging areas and critical winter habitat for ring-necked pheasant and other associated wildlife using agricultural lands.

In addition, pheasant hunting in the general area has provided significant recreational opportunity to the citizens of the state as well as economic benefits to the local communities. There have been significant declines in pheasant numbers over the past 20 years due to clean farming practices and major advances in farming technology. Possible mitigation efforts focusing on the ring-necked pheasant could help improve some populations. Such mitigation may also offer opportunities for share-cropping agreements, landowner compensation and cooperative landowner agreements to benefit wildlife.

Comments: (habitat types and indicator species)

Some commentors thought that the effects of predators on the area should be discussed, while others found it refreshing to see the use of bobcat as a target species because it represented a guild of wildlife largely overlooked in other programs. A few commentors thought too many indicator species were chosen, while others disagreed with the order of mitigation objectives.

Conversely, many commentors agreed in general with the selection of indicator/evaluation species to represent non-tribal and tribal wildlife losses, and further agreed with the general pacing reflected by the mitigation objectives. These commentors indicated that the objectives did reflect the proper emphasis of wildlife habitat needs and would provide a reasonable approach to Chief Joseph Dam wildlife mitigation in the future.

Response:

The rationale and selection of indicator species were agreed upon by the Chief Joseph Wildlife Mitigation Interagency Technical Work Group formed to assist and direct the Chief Joseph Wildlife Mitigation Planning Study. This group is made up of the various agencies, tribes and local government. Members of the Grand Coulee/Chief Joseph Wildlife Mitigation Steering Committee were also consulted. The criteria for selection is discussed in the Wildlife Habitat Impact Assessment Chief Joseph Dam Project Report. The number of indicator species used during this study was generally consistent with previous loss assessment studies on the Columbia mainstem. Tribal, nontribal, federal and local considerations were also reflected by the number of species utilized.

The nontribal and tribal wildlife mitigation objectives were developed to reflect current wildlife needs both locally and regionally, and in conformance with NPPC wildlife mitigation standards per the amended Wildlife Rule.

The bobcat was used to address losses associated with Rock and Rockland habitats and as a predator, represented the guild of species occupying these habitats.

The wildlife mitigation objectives generally emphasize wildlife species that are associated with shrub-steppe habitat, special status species (such as threatened or endangered), riparian habitat components, and species and habitat diversity and complexity. Each mitigation objective focuses on a representative wildlife species which, when addressed, will benefit an entire group of wildlife dependent on similar habitats.

Formal public input on objectives was sought during the public hearings and from the circulation of the draft study report. Numerous changes have been made in nontribal priorities as a result.

3. Effects of Hydroelectric Power

Comment: (riparian zone)

Some commentors feel that significant riparian zones still exist around the shores of Rufus Woods Lake. Others felt more waterfowl exist now than prior to dam construction.

Response;

Shorelines surrounding the lake are not natural as a result of power peaking from hydroelectric operations. In a natural state, vegetation and wildlife would inhabit areas down to the waterline forming stable communities of living organisms. Constant fluctuations, now present on the lake, have disrupted the water table. Riparian and associated wildlife. intolerant of these changes, are notably absent. The original construction of Chief Joseph Dam effectively eliminated most riparian habitat adjacent to the Columbia River. Much of the riparian areas existing today have resulted from mitigation efforts associated with the ten-foot pool rise.

Waterfowl present today are indicative of other factors involving their populations. The present Rufus Woods Lake is too deep and swift for diving ducks that used the area as winter habitat before the dam was constructed, and other species of waterfowl can no longer find suitable nesting cover to raise broods. Some species, such as the Canada Goose, are utilizing the nest tubs and island habitat that was part of the ten-foot mitigation conducted by the COE. There is no evidence that waterfowl in the area are more abundant than before construction of the dam.

Comment: (Columbia River)

Some commentors disagreed with wording used in the report describing the area along the Columbia River as an "oasis in the arid Eastern Washington landscape" and as "complex habitats". They felt the Columbia was basically a scour zone which supported very little permanent riparian vegetation.

Others commented that the study reflected a credible representation of habitat losses and supported the findings.

Response;

Free flowing riparian habitats, like those existing before the dams, were unique. They were composed of diverse communities of plants and animals, which in turn supported other wildlife, particularly during times of stress. The infrequency of major floods allowed natural riverine plant and animal communities to re-establish. Current reservoir fluctuations, due to peak power demands, raise and lower the shorelines prohibiting natural succession and the establishment of riparian vegetation and associated wildlife.

Comment: (economic impacts)

Some commentors felt priorities for people, like electricity and making a living, should take priority in mitigation planning. Others would restrict further development, use alternative energy sources and save our natural resources for future generations.

Response;

Local communities and the region have benefitted positively by the construction of Chief Joseph Dam through the generation of hydropower. However, wildlife also provide significant benefits to people from both a recreational and economic standpoint. Wildlife mitigation efforts will occur in close proximity to Chief Joseph Dam to ensure that the local communities have an opportunity to make use of this resource.

4. Irrigation and Agriculture

Comment: (construction and irrigation benefits)

Some commentors stated populations of wildlife have increased and that fact should be reflected in the loss assessment. They felt benefits actually occurred due to reservoir construction and that no credit had been given for benefits of irrigation.

Response:

Some wildlife populations, such as mule deer, may have increased due to agricultural practices in the vicinity, not as a result of the construction of Chief Joseph Dam. Indirect benefits of irrigation projects did occur, especially for waterfowl and exotic upland bird species such as pheasant. However, those initial benefits have been steadily eroded due *to* improved farming practices and the need to cultivate marginal crop lands to make operations cost effective and take advantage of market conditions.

In the Columbia Basin temporary new habitats were created for a wide number of introduced and exotic species. Although this has been seen by some as a "trade-off" for "displaced" native species, the permanency of new species has never been assured in past and present planning. Suitable, viable safeguards for wildlife, within irrigation projects, are largely non-existent in face of intensification of agricultural development.

The facility was basically constructed for the single purpose (98 percent) of providing hydro-electric power. The focus of the loss assessment, consistent with the **NPPC's** Wildlife Rule, was on the inundation impacts directly tied to hydropower construction and operation. An examination of agricultural/irrigation impacts (positive and negative) was beyond the scope of this effort.

While some species may have benefitted from agricultural practices, other, less tolerant species, such as sharp-tailed grouse and sage grouse, have been significantly impacted by the conversion of native shrub-steppe habitat. **Over** 60 percent of original shrub-steppe habitat in eastern Washington has been eliminated, and the majority of that remaining is extremely fragmented.

A future evaluation of agricultural impacts would be based upon an ecosystem approach and consider all habitat types and native wildlife originally present. It is highly unlikely that sharp-tailed grouse or sage grouse, both current state and federal candidate species for classification as threatened or endangered status, would be traded off for benefits to other species such as mule deer.

The nontribal mitigation objective tied to habitat represented by mule deer has been given a low priority.

Comment: (third party involvement)

Some commentors stated that wildlife mitigation was not justified or necessary. Some individuals wanted to know whether an independent third party will be used to verify the estimates of the Chief Joseph Dam wildlife habitat losses.

Response:

NPPC determined that questions regarding wildlife habitat loss estimates for federal hydropower reservoirs should be addressed by an independent analyst. The NPPC is currently contracting with an independent third party to assess the accuracy of the wildlife habitat loss assessment developed by the agencies and tribes for the entire Columbia Basin. Part of the contract requires the consultant to provide an opinion on whether gains and losses from irrigation are significant.

5. Tribal Concerns

Comment: (mule deer)

Several comentors suggested that mule deer, having come from depressed populations of the 1920's and 1930's, are a nuisance, and should not have been selected for priority status.

Response:

Objectives written for both tribal and nontribal portions of the Chief Joseph Wildlife Mitigation Study are designed to restore habitat and species diversity. Some species are of greater significance because tribal goals reflect the subsistence and ceremonial needs of tribal members, while nontribal objectives are more oriented toward wildlife population stability and recreational opportunities, both consumptive and appreciative. Mule deer and other indicator species, evaluated for proposed mitigation, represent habitat types that were lost due to the original construction and operation of the Chief Joseph Dam Project. Mitigation action that will occur will actually be directed towards habitat types represented by these indicator species. Species on the prioritized wildlife mitigation objectives lists represent guilds of wildlife species which utilize, and are dependent upon, a particular type of habitat.